POWER TRAIN

CONTENTS

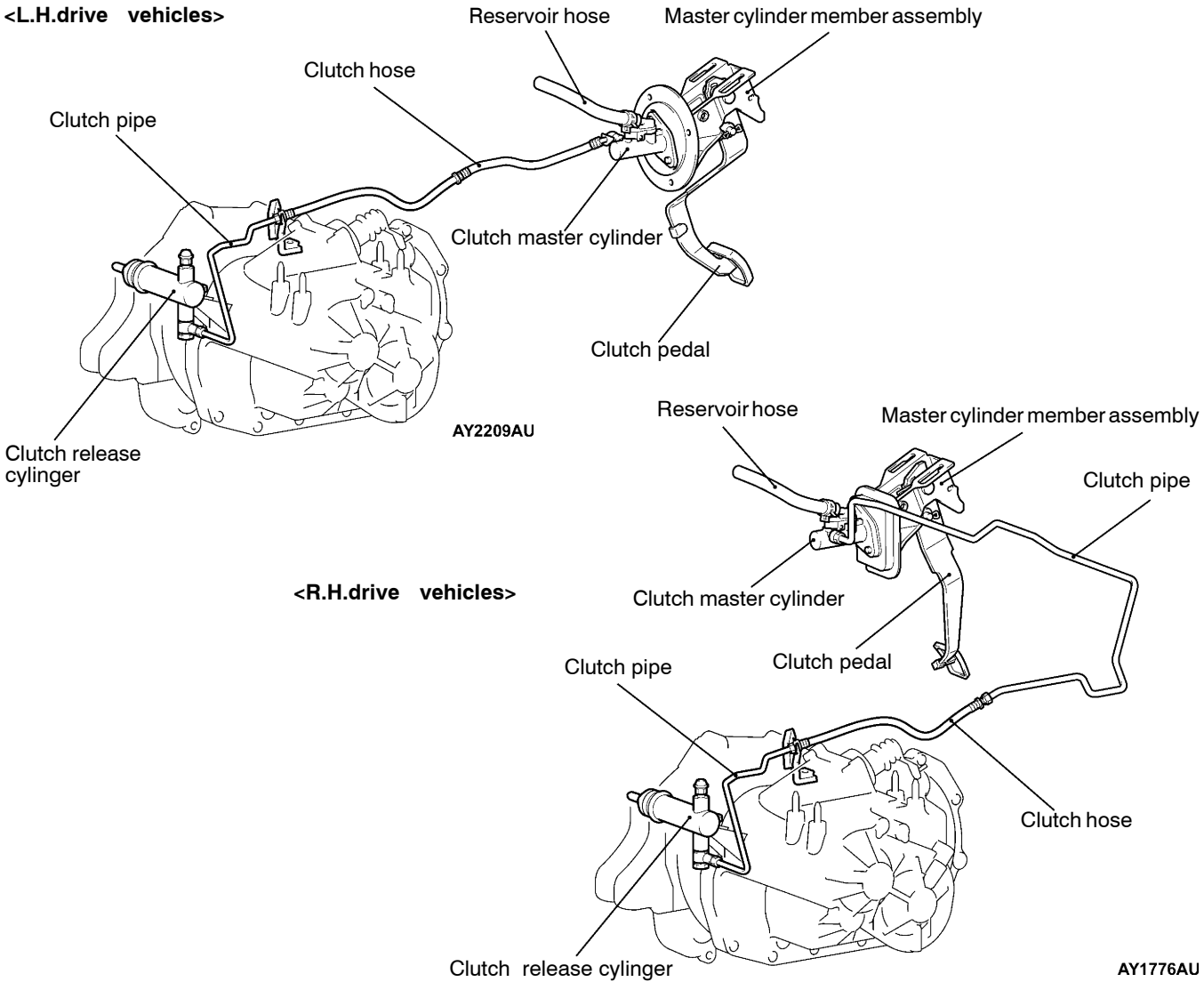
CLUTCH

SPECIFICATIONS

Items	Specifications
Engine model	4G63-DOHC-Intercooler Turbocharger
Clutch disc type	Dry single plate type
Clutch disc facing diameter O.D.×I.D. mm	240×160
Clutch cover type	Diaphragm spring pull type
Clutch cover set load N	9,320 ± 750
Control system	Hydraulic type
Release cylinder I.D. mm	20.64
Master cylinder I.D. mm	15.87
Clutch fluid	Brake fluid DOT 3 or DOT 4

CLUTCH CONTROL CONFIGURATION

<L.H.drive vehicles>



<R.H.drive vehicles>

MANUAL TRANSMISSION

The manual transmission is a W5M5 transmission. This transmission incorporates the following changes from the F5M4 type transmission mounted to GALANT.

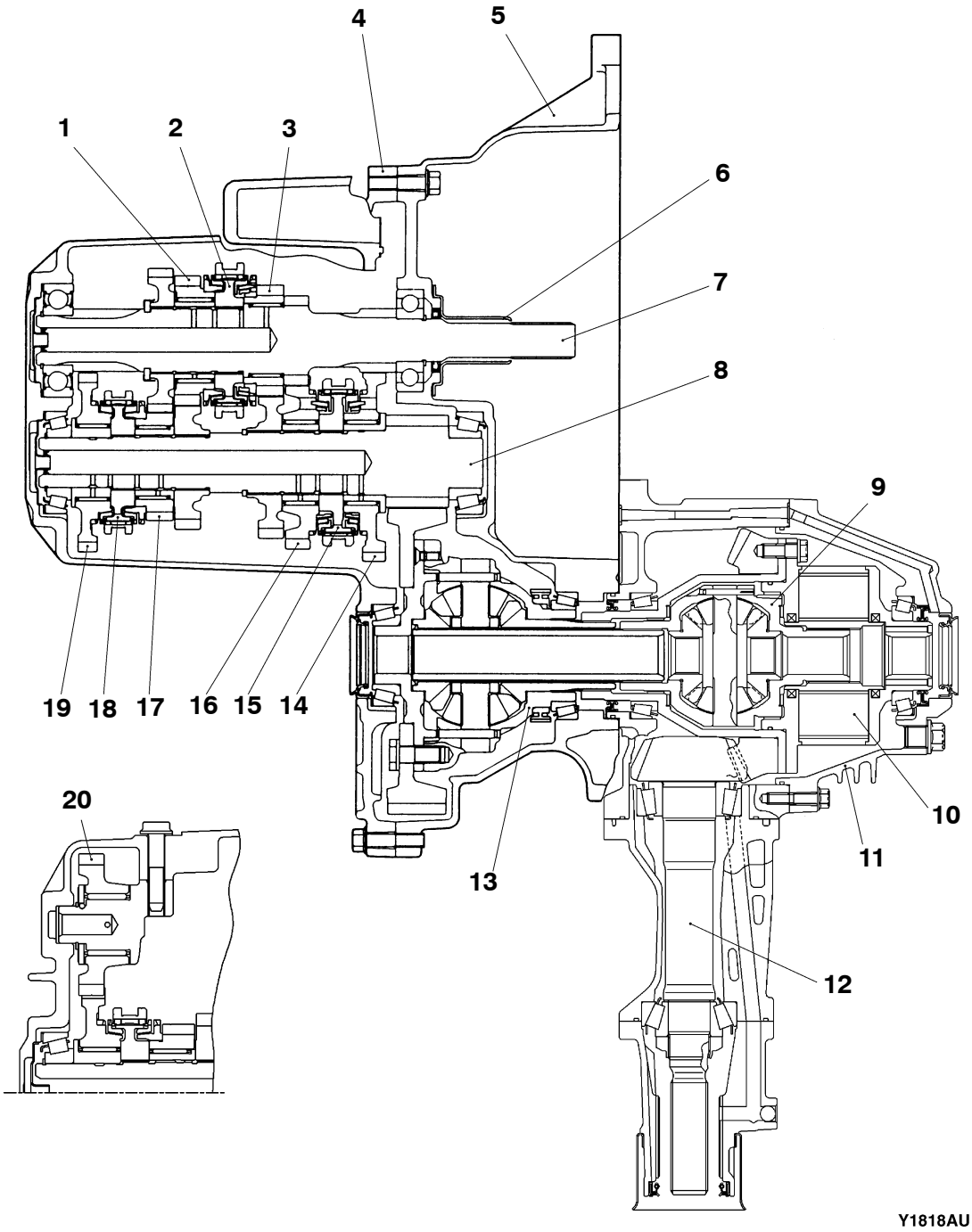
- With the incorporation of 4WD, the center differential has been positioned at the front differential of the 2WD, and the front differential has been positioned inside the transfer.
- The kinetic performance has been improved by setting a helical gear LSD for the front differential. <RS, RS II: Option>
- With the adoption of the active center differential (ACD), an hydraulic multi plate clutch has been adopted for the transfer limited slip differential. <RS, RS II: Option> (Refer to P.2-17 for details of the hydraulic multi plate clutch.)

SPECIFICATIONS

Item		Specifications	
Classification		RS, RS II	RS, RS II (Super cross gear specifications)
Transmission type		W5M51	
Engine type		4G63-DOHC-T/C	
Transmission type		5 steps forward, 1 step reverce, always in contact)	
Gear ratio	1st	2.785	←
	2nd	1.950	←
	3rd	1.407	1.444
	4th	1.031	1.096
	5th	0.720	0.825
	Reverse	3.416	←
Final deceleration ratio		4.529	←
Helical gear LSD (Front differential)		No	Yes
Transfer	Deceleration ratio	3.307	←
	Limited slip differential	VCU or hydraulic multi plate clutch (ACD)	←

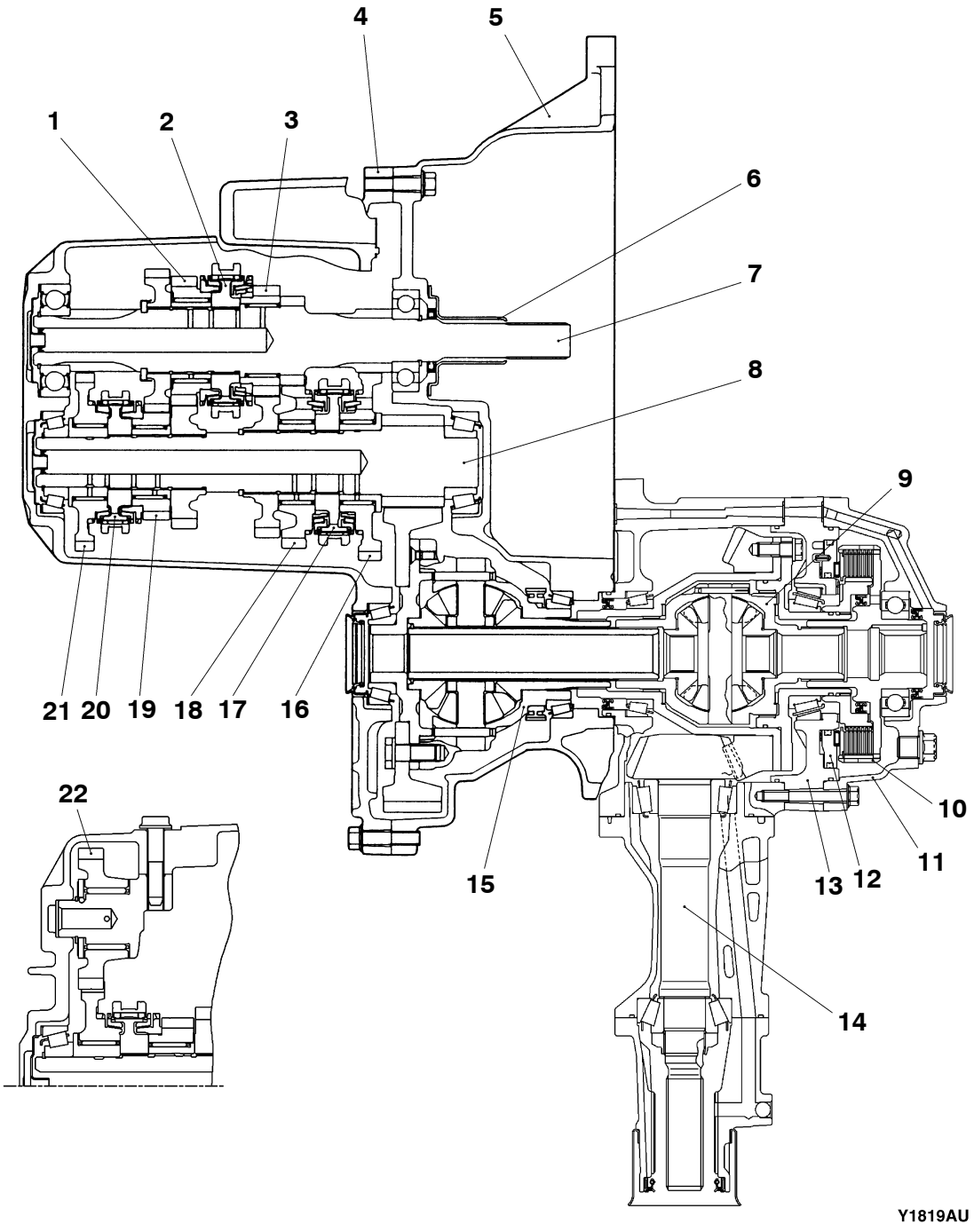
SECTIONAL VIEW

W5M51 <Vehicle with VCU>



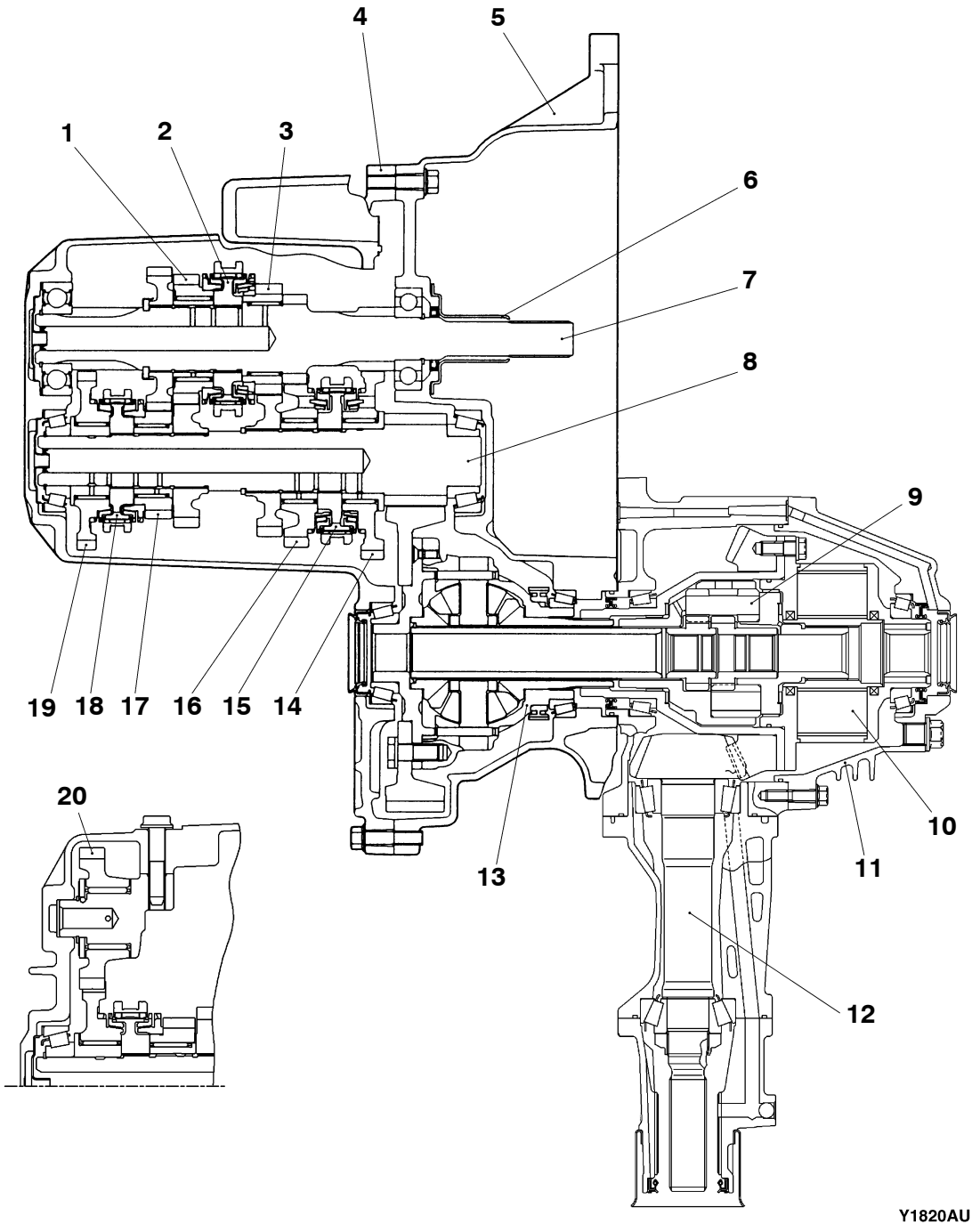
1. 4th gear
2. 3rd - 4th synchronizer
3. 3rd gear
4. Transmission case
5. Clutch housing
6. Clutch release bearing retainer
7. Input shaft
8. Output shaft
9. Front differential
10. Viscous coupling unit (VCU)
11. Transfer cover
12. Hypoid pinion
13. Center differential
14. 1st gear
15. 1st - 2nd synchronizer
16. 2nd gear
17. 5th gear
18. 5th - reverse synchronizer
19. Reverse gear
20. Reverse idler gear

W5M51 <Vehicle with ACD>



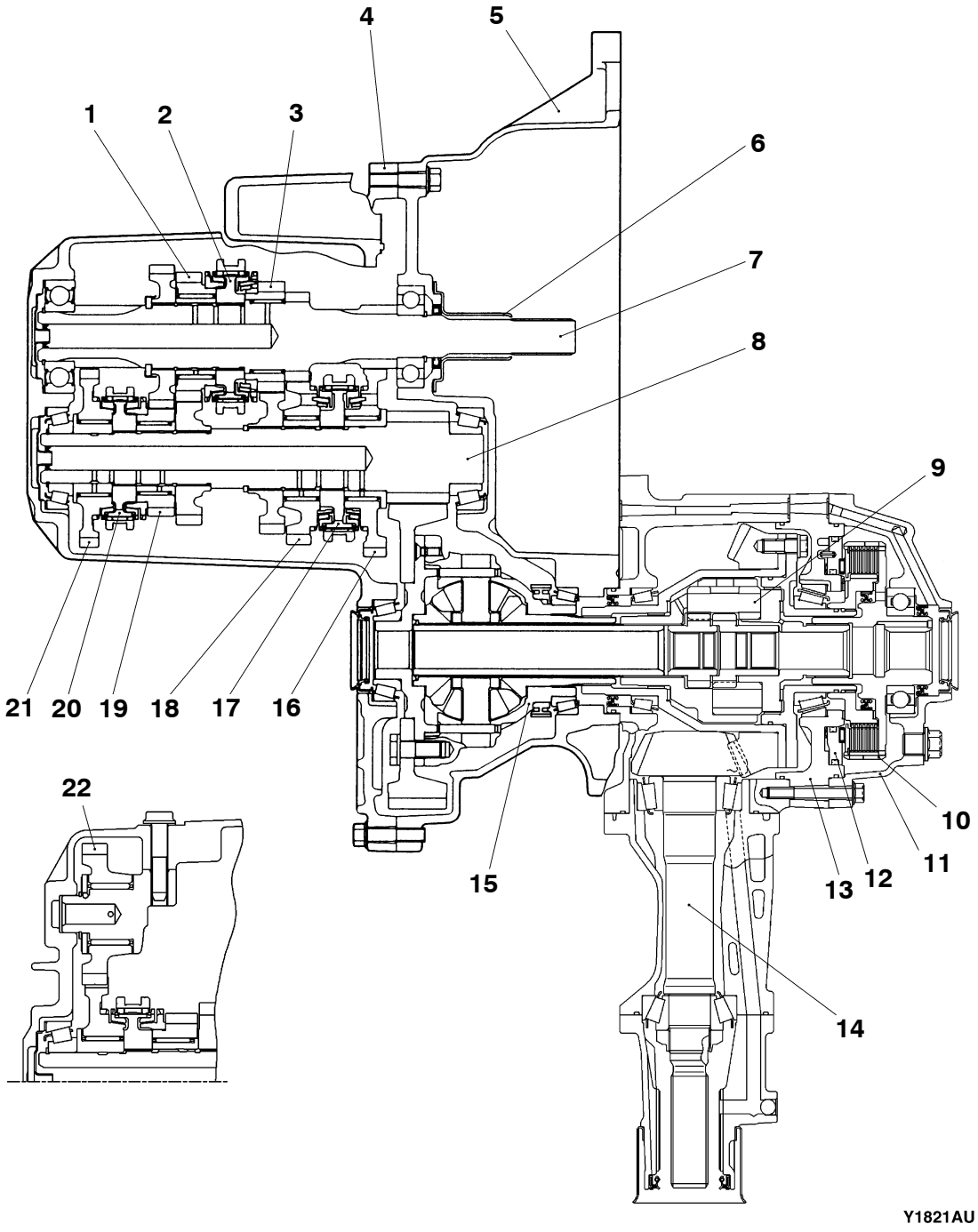
1. 4th gear
2. 3rd - 4th synchronizer
3. 3rd gear
4. Transmission case
5. Clutch housing
6. Clutch release bearing retainer
7. Input shaft
8. Output shaft
9. Front differential
10. Clutch housing
11. Transfer cover
12. Piston
13. Transfer hydraulic case
14. Hypoid pinion
15. Center differential
16. 1st gear
17. 1st - 2nd synchronizer
18. 2nd gear
19. 5th gear
20. 5th - reverse synchronizer
21. Reverse gear
22. Reverse idler gear

W5M51 <Vehicle with Helical Gear LSD and VCU>



1. 4th gear
2. 3rd - 4th sychronizer
3. 3rd gear
4. Transmission case
5. Clutch housing
6. Clutch release bearing retainer
7. Input shaft
8. Output shaft
9. Front differential (Helical gear LSD)
10. Viscous coupling unit (VCU)
11. Transfer cover
12. Hypoid pinion
13. Center differential
14. 1st gear
15. 1st - 2nd sychronizer
16. 2nd gear
17. 5th gear
18. 5th - reverse synchronizer
19. Reverse gear
20. Reverse idler gear

W5M51 <Vehicle with Helical Gear LSD and ACD>



1. 4th gear
2. 3rd - 4th sychronizer
3. 3rd gear
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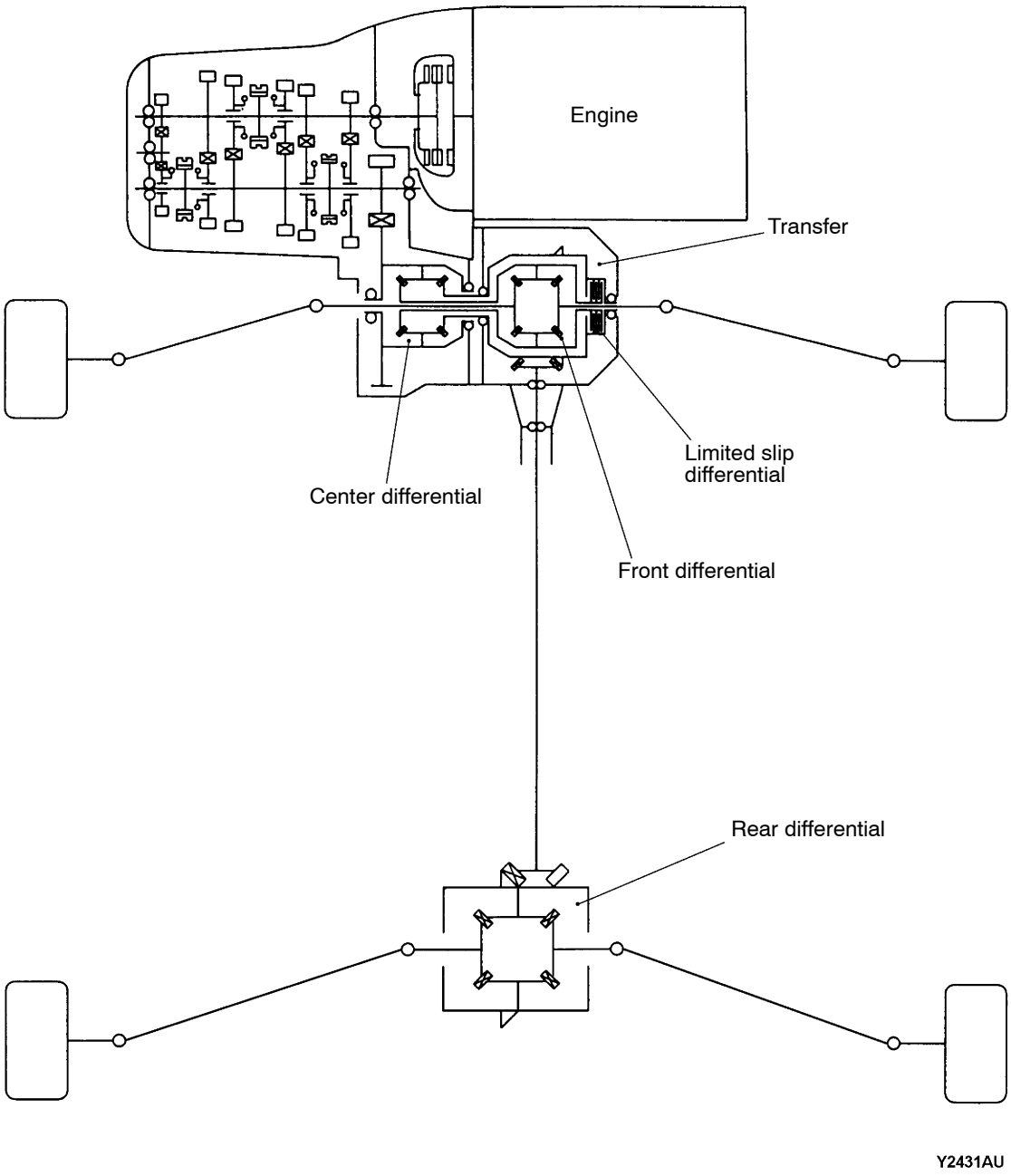
7. Input shaft
8. Output shaft
9. Front differential (Helical gear LSD)
10. Clutch housing
11. Transfer cover
12. Piston
13. Transfer hydraulic case
14. Hypoid pinion
15. Center differential
16. 1st gear
17. 1st - 2nd sychronizer
18. 2nd gear
19. 5th gear
20. 5th - reverse synchronizer
21. Reverse gear
22. Reverse idler gear

4WD SYSTEM

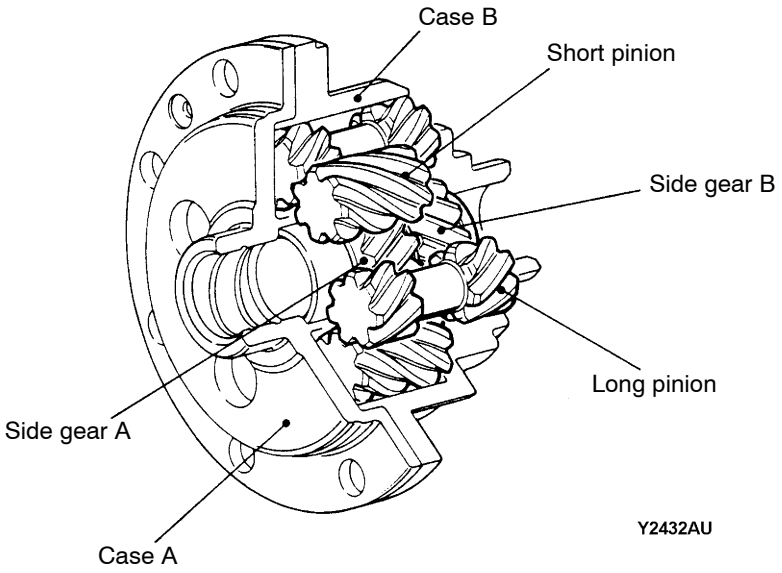
The 4WD system is a center differential full-time 4WD with limited slip differential.
The center differential has been positioned at the front differential of the 2WD transmission, and the front differential has been positioned inside the transfer. The limited slip differential of the center differential has been positioned at the back of the front differential in the transfer.
For the limited slip differential of the center differential, a viscous coupling unit (VCU) or active center differential (ACD) has been adopted.

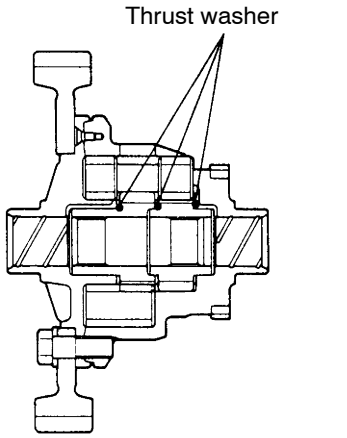


POWER TRAIN

Helical Gear LSD

The helical gear LSD is composed of four long pinions, four short pinions, three thrust washers, side gears A and B, and cases A and B.
The long pinions are in contact with the side gear B and short pinions, while the short pinions are in contact with the side gear A and long pinions.



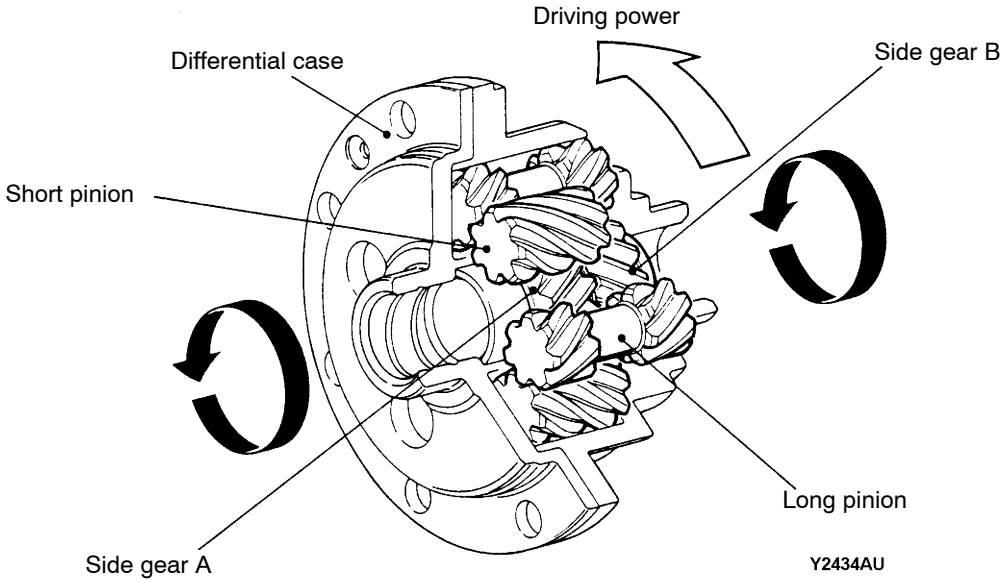


Power Flow

Operations in forward driving

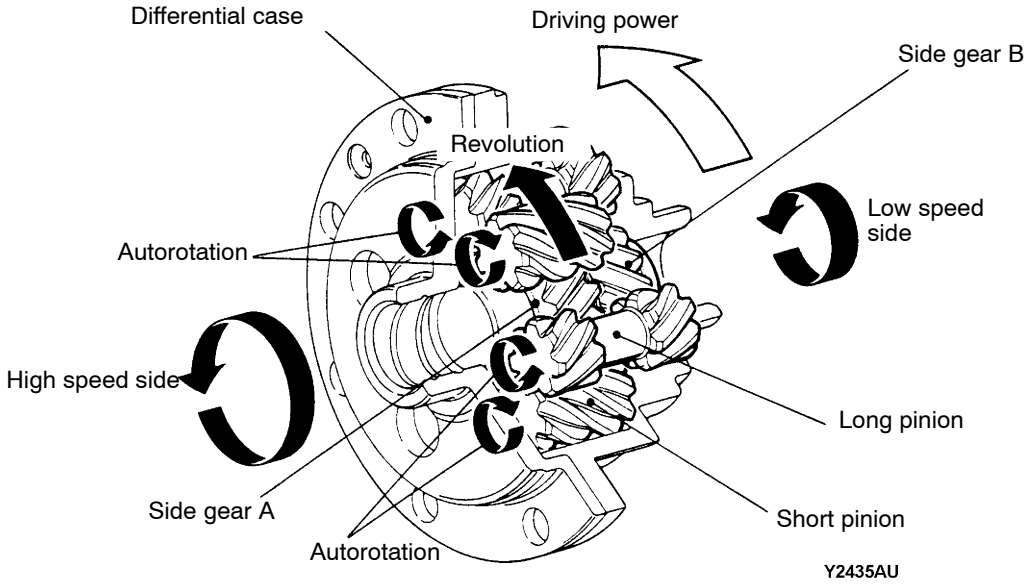
During forward driving, as the differential case and and drive shaft rotate at the same speed, they rotate at the assembly without the inside of the differential moving.
The driving force at this time will be transmitted as follows.

Differential case → Long and short pinions → Side gears A and B → Drive shaft



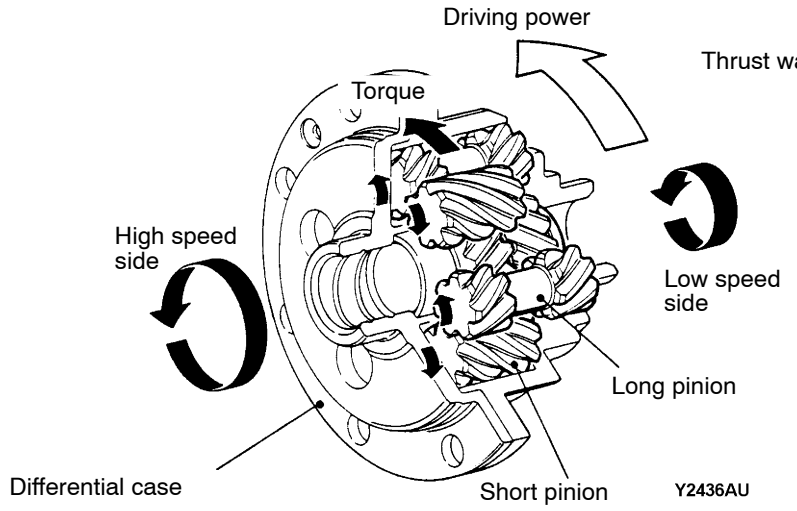
Operations during differential (when there is rotational difference between the left and right wheels)

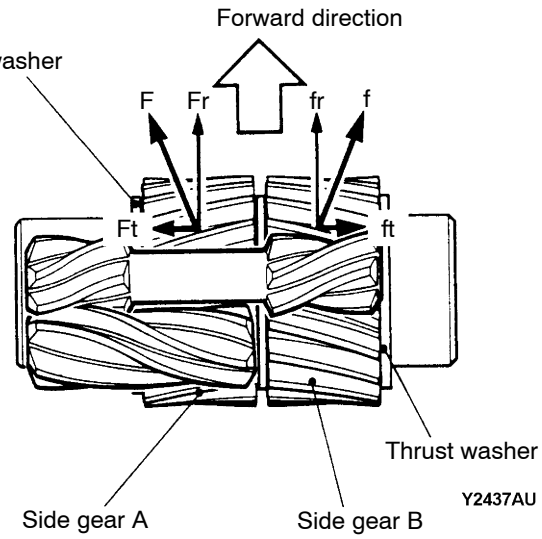
When the frictional coefficient of the left and right wheels are more or less equal, and a slight rotational difference occurs at the left and right wheels (normal turning), rotational difference will also occur between side gears A and B. In this case, while the long pinions and short pinions mutually rotate in the reverse direction, the vicinity of side gears A and B revolves and absorbs the speed difference. In this way, like normal differential, the high speed side accelerates for the revolved amount in respect to the revolution speed of the differential case,while the low speed side rotates in the decelerated state and performs differential.



Operations during Limited Slip Differential

When the loads of the left and right wheels become unbalanced due to changes in road surface conditions and sudden turning, the driving torque of side gears A and B will differ.
As mentioned earlier, because side gears A and B are in contact via the respective long and short pinions, the gears influence each other, resulting in contact reaction force (F and f) between the long pinion and side gear B, and the short pinion and side gear A.
The separating force (Ft and ft) in the axial direction of the contact reaction force causes side gears A and B to be pushed and extended. From this force, side gears A and B are pushed against the thrust washer (case) and friction occurs.
The separating force (Fr and fr) in the radial direction of the contact reaction force causes the long pinion and short pinion to be pushed against the differential case (cases A and B). This force generates a large friction between the long pinion, short pinion, and differential case (cases A and B).
Friction also occurs on the gear with the generation of contact reaction force (F and f) of the four gears (pinions).
These frictional forces cause the generation of frictional torque at each section according to the size of the driving torque input to the differential case, and the generation of limited slip differential torque proportionate to the input torque.

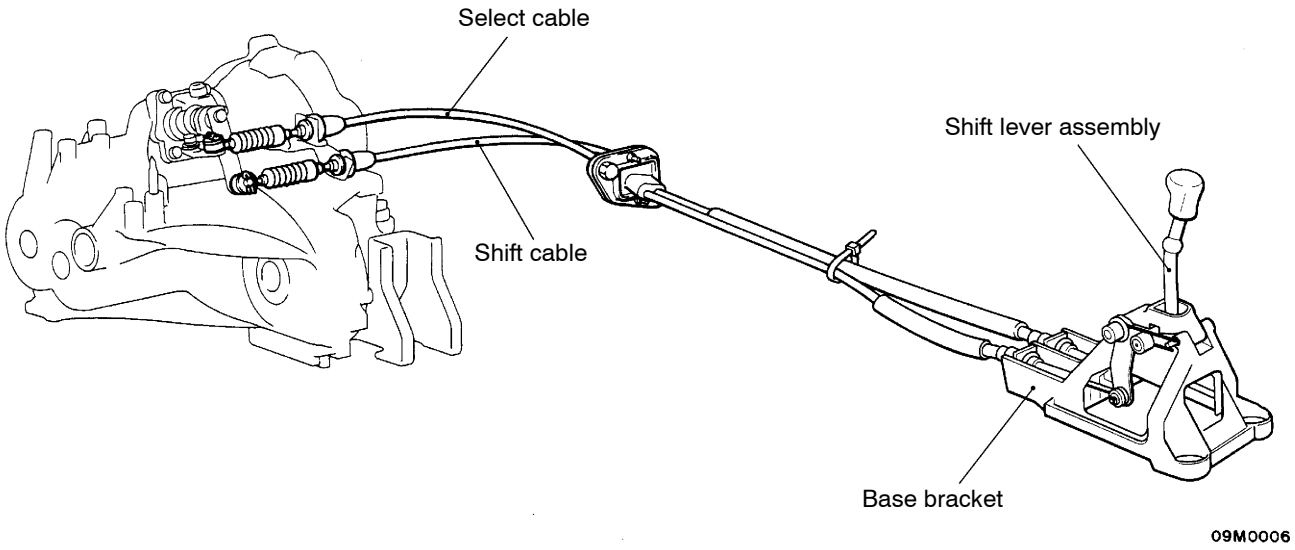




TRANSMISSION CONTROL

- The shift lever construction adopted the spherical rotary shaft fulcrum type to assure a non-rickety.
- The base bracket material adopted a synthetic resin for the weight reduction.
- The shift and select cable securing portions have been elastically supported to reduce contained sound.
- A mass-filled shift knob has been adopted to minimize the binding touch at the time of a shift.

CONSTRUCTION DIAGRAM



ACTIVE CENTER DIFFERENTIAL (ACD) AND ACTIVE YAW CONTROL (AYC)

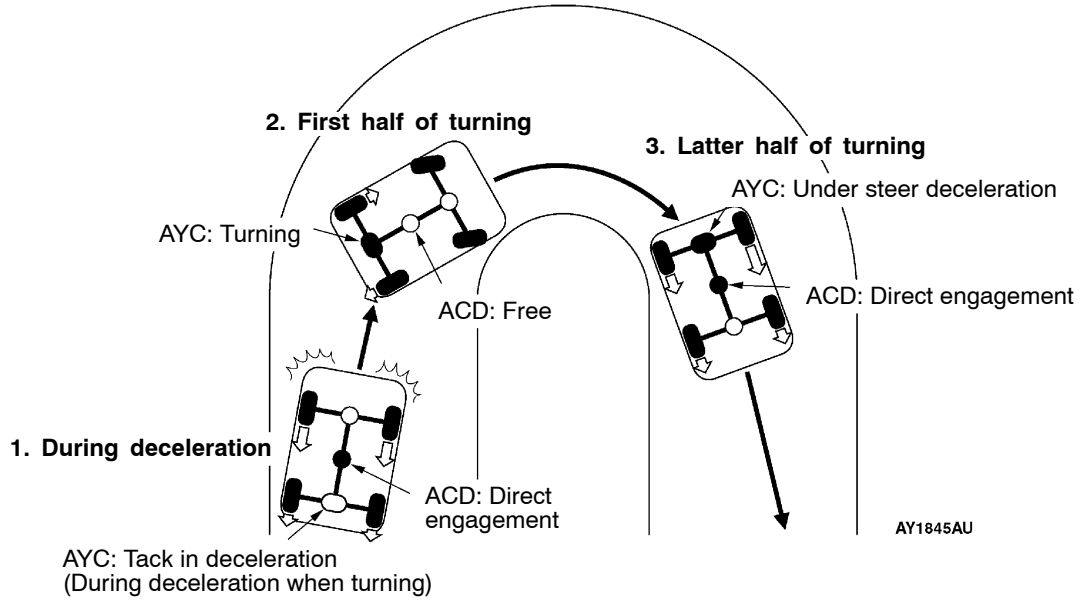
The LANCER EVOLUTION-VII adopts the newly developed active center differential (ACD).
The driving performance of the ACD has been improved by varying the center differential drive by electronic control.
The yaw moment is directly controlled by the active yaw control (AYC) adopted from EVOLUTION-V onwards to improve the turning performance.
By combining and integratedly controlling these two systems, the driving performance has been further improved.

	RS, RS II
ACD	Option
ACD and AYC	Option

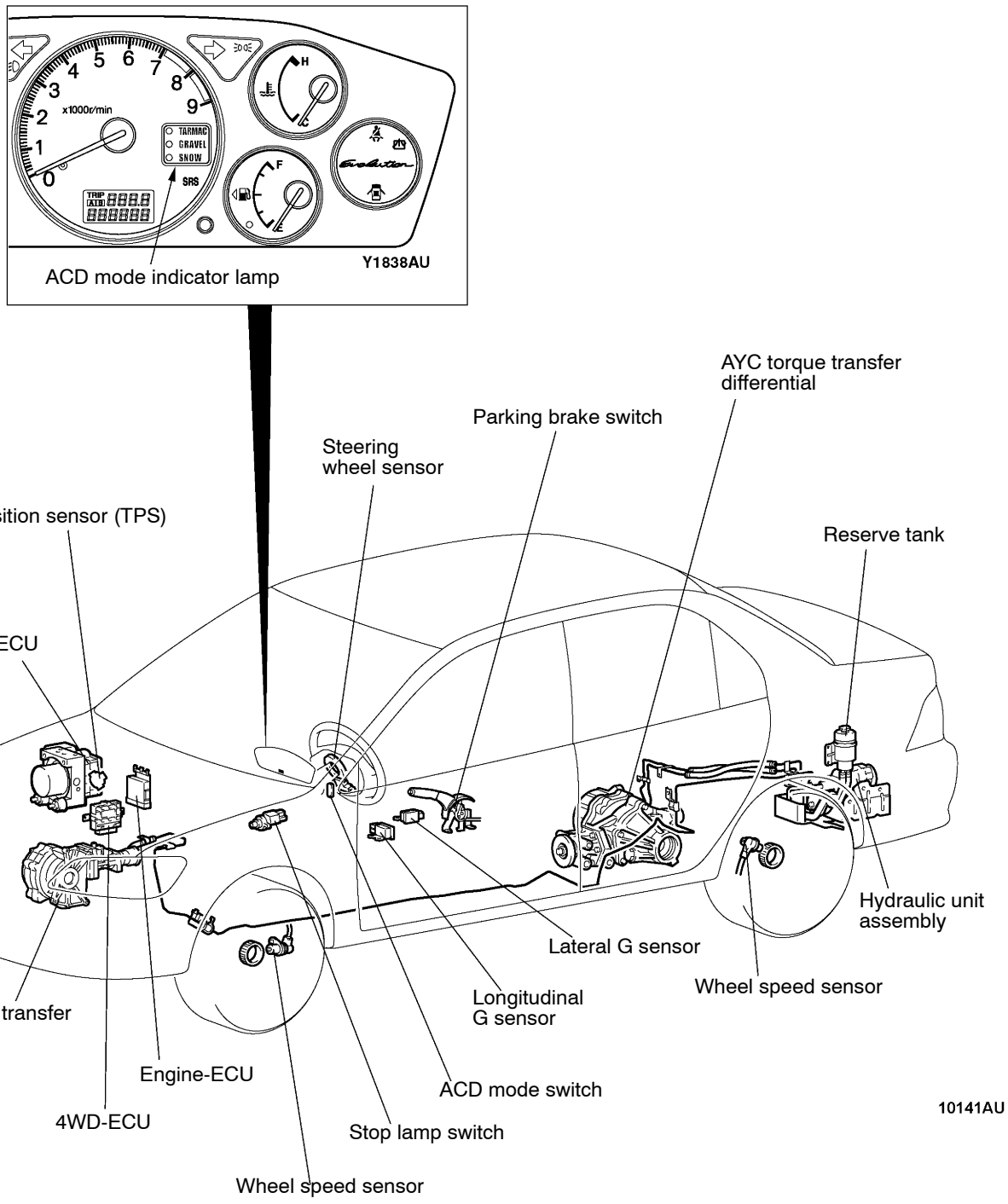
OUTLINE OF CONTROL

The following effects are obtained by equipping the ACD or ACD and AYC.

State of vehicle	ACD	AYC	Integrated control effects
1. During deceleration (Before corners)	Similar to the direct engagement 4WD by increasing the center differential during sharp deceleration to improve stability in deceleration.	[When decelerated during turning] The driving power is moved to the inside turning wheel to reduce the tack in.	Stability against various external influences such as poor road conditions and driver operations have been improved.
2. First half of turning (Corner entrance)	The center differential restriction is reduced according to the steering angle and operation speed to set the center differential as close as possible to the free state and improve turning performance.	The driving power is moved to the outside turning wheel according to the steering angle and operation speed to improve the turning performance.	The response to steering operations (brisk movement) is improved as much as possible.
3. Latter half of turning (Corner exit)	The center differential restriction is enhanced according to the amount the acceleration is stepped to set similar effects as the direct engagement 4WD and improve the acceleration performance.	The driving power is moved to the outside turning wheel according to the amount the acceleration is stepped to decrease the acceleration understeer and improve turning performance.	Two elements (acceleration and turning) have been improved simultaneously.



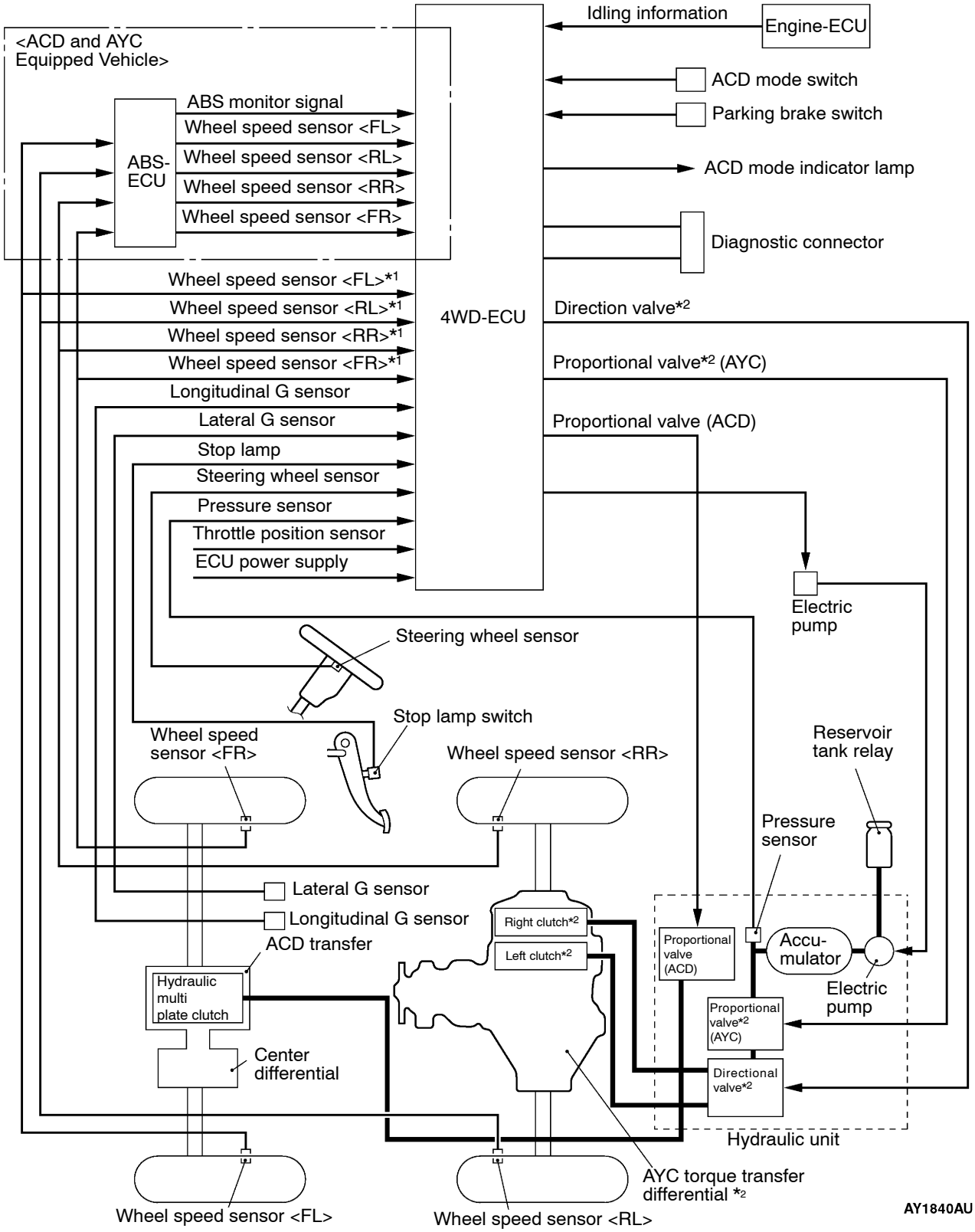
COMPONENT VIEW



LIST OF MAIN COMPONENTS

Components		Outline of function
ACD transfer		Controls the transmission torque of the hydraulic multi plate clutch by the hydraulic unit, and adjusts the center differential.
4WD-ECU		Processes information of various sensors and switches, calculates the hydraulic multi plate clutch transmission torque and amount of AYC torque movement and direction, and controls the hydraulic unit on the basis of them.
Engine-ECU		Sends the engine idling state to the 4WD-ECU.
ABS-ECU		Outputs the ABS monitor signal to the 4WD-ECU.
Throttle position sensor (TPS)		Sends the throttle valve opening angle to the 4WD-ECU.
Longitudinal G sensor		Sends the acceleration in the front and rear directions of the vehicle to the 4WD-ECU.
Lateral G sensor		Sends the acceleration along the side of the vehicle to the 4WD-ECU.
Steering wheel sensor		Sends the steering angle and neutral position to the 4WD-ECU.
Wheel speed sensor		Sends the wheel speed to the 4WD-ECU.
Stop lamp switch		Sends the brake operating state to the 4WD-ECU.
Parking brake switch		Sends the operating state of the parking brake to the 4WD-ECU.
ACD mode indicator lamp		Displays the ACD control mode (TARMAC, GRAVEL, SNOW).
		Lights the all mode lamp during fail. (Lights for about 1.5 seconds after the ignition switch is turned ON)
ACD mode switch		Switches the ACD control mode (TARMAC, GRAVEL, SNOW).
Hydraulic unit	Pressure sensor	Sends the pressure of the accumulator to the 4WD-ECU.
	Electric pump	Generates oil pressure for clutch operations.
	Directional valve	Controls whether to supply the oil pressure to the left or right AYC clutch.
	Proportional valve <ACD>	Controls hydraulic supplied to hydraulic multi plate clutch of the ACD.
	Proportional valve <AYC>	Controls oil pressure supplied to the AYC clutch.
Electric pump relay		Supplies the power to the electric pump.
AYC torque transfer differential		Controls the transmission torque of the left and right clutches according to the oil pressure from the hydraulic unit, and adjusts the left and right driving power difference of the rear wheels.

OUTLINE OF ACD AND AYC



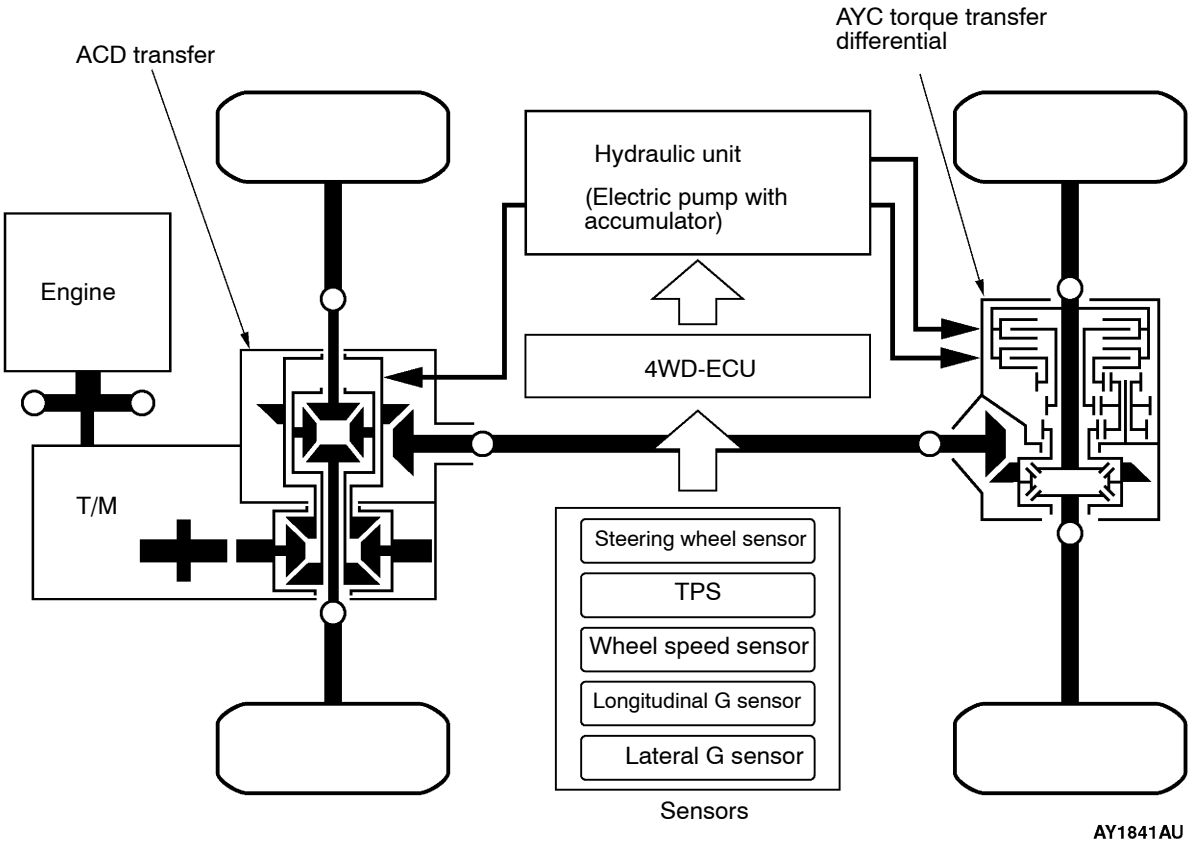
NOTE
1. *1 indicates equipped with only ACD.
2. *2 indicates equipped with ACD and AYC.

DESCRIPTION OF STRUCTURE AND OPERATIONS

The ACD system adopts a transfer limited slip differential as the hydraulic multi plate clutch, and electronically controls it using sensors, 4WD-ECU, and hydraulic unit.

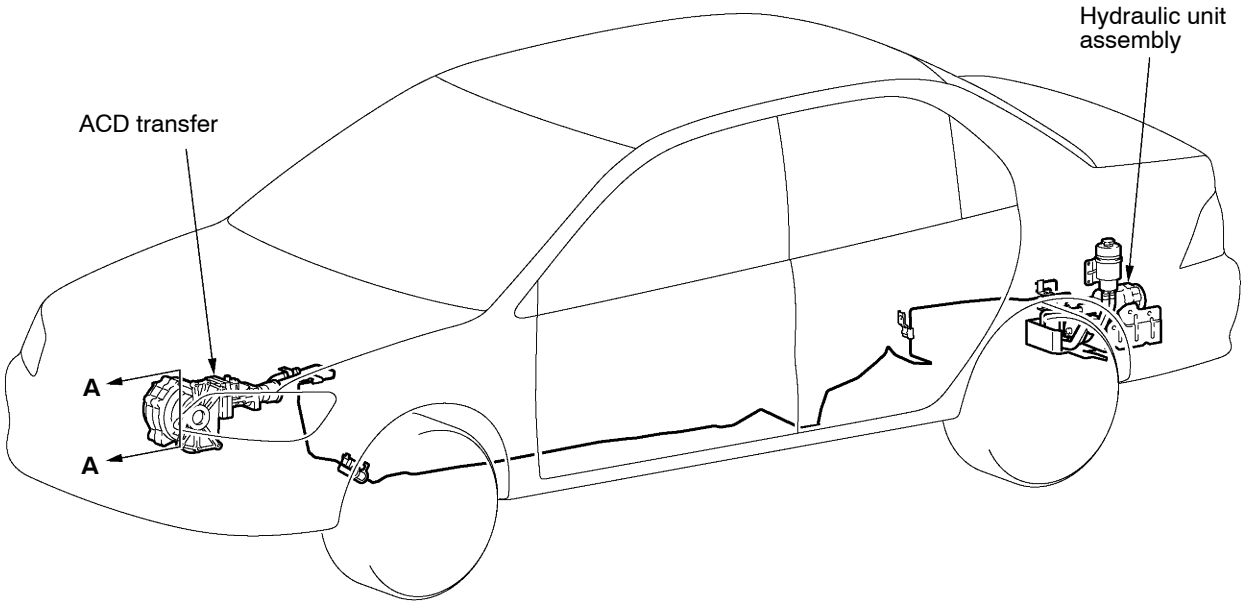
NOTE
Refer to P.2-30 for details on the AYC structure and operations.

SYSTEM STRUCTURE

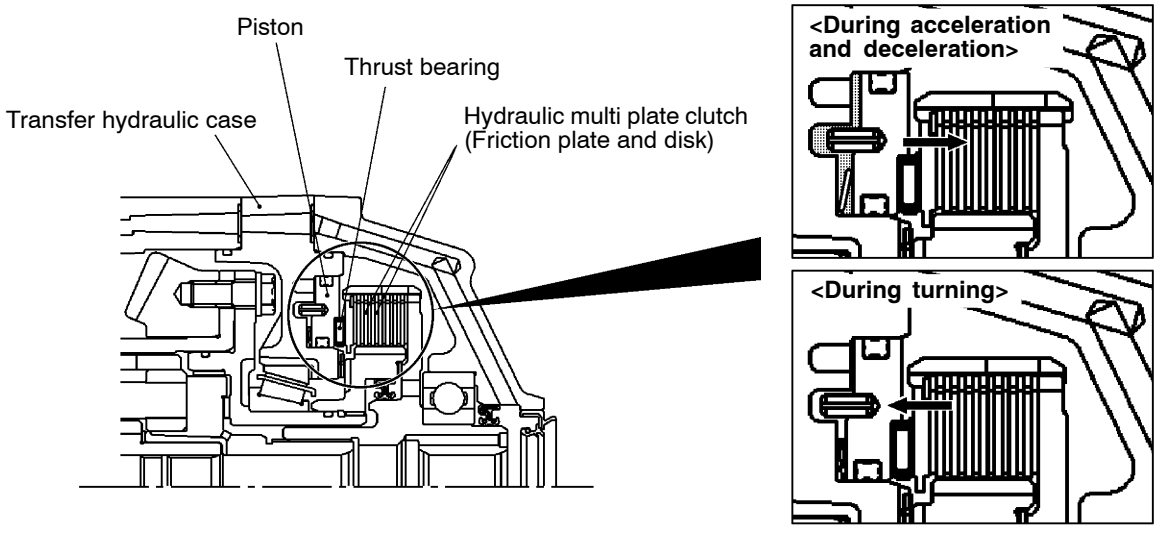


TRANSFER LIMITED SLIP DIFFERENTIAL

During acceleration and deceleration, the piston is moved in the right direction according to the oil pressure from the hydraulic unit to connect the hydraulic multi plate clutch (friction plate and disc) and set the center differential to the direct engagement state as much as possible. This improves the acceleration performance and stability during deceleration.
During turning, the oil pressure from the hydraulic unit stops, the piston operates in the left direction to release the hydraulic multi plate clutch and free the center differential to improve the turning performance.
If the parking brake is pulled while driving at a vehicle speed above 5 km/h, the hydraulic multi plate clutch will also be released and the center differential set as close as possible to the free state.



Section A - A



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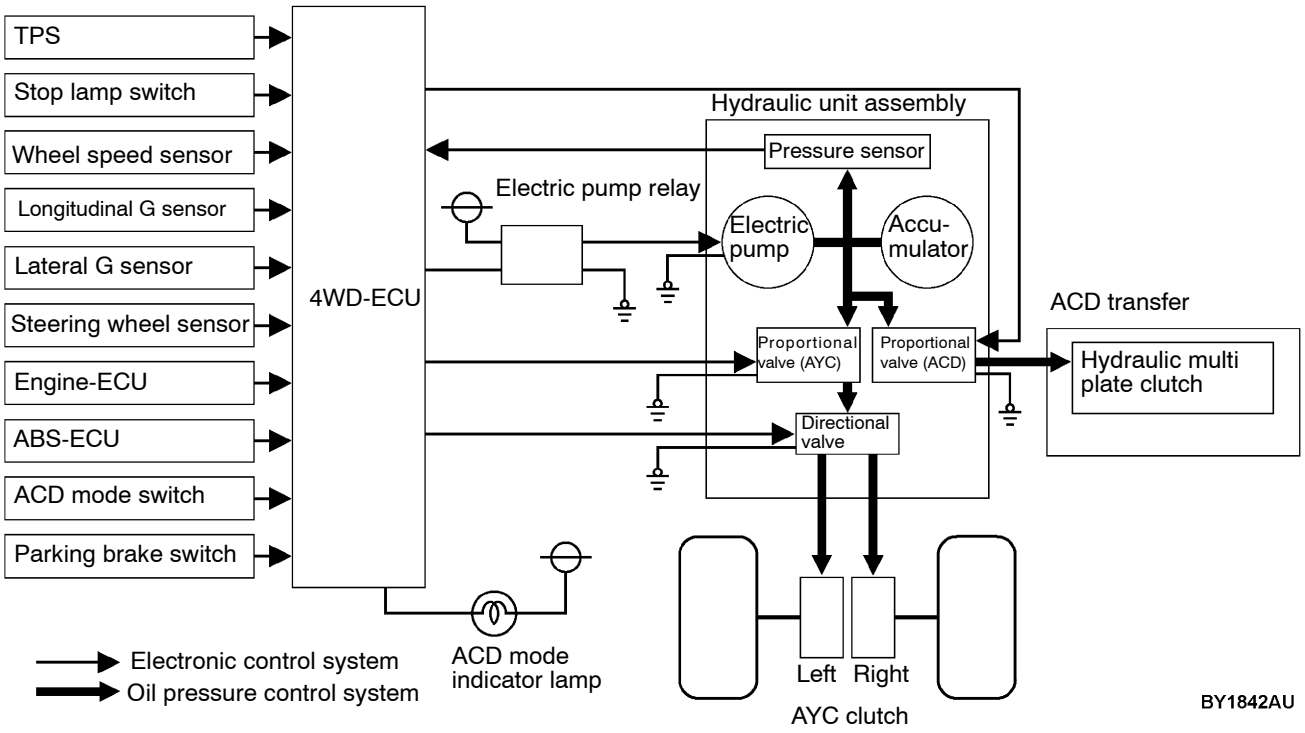
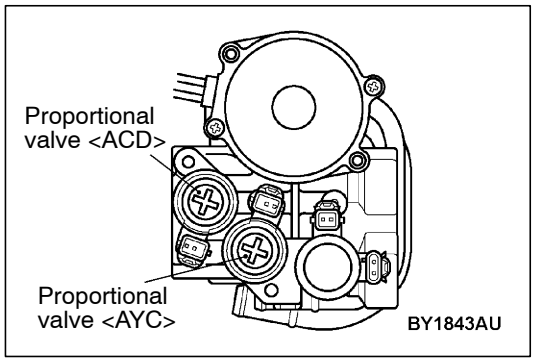
HYDRAULIC UNIT

The hydreaulic unit is composed of the accumulator (electric pump, pressure sensor, accumulator) and pressure controller (proportional valve, directional valve).
The pressure accumulator intermittently operates the pump, and accumulates the control pressure required in the accumulator.
The pressure controller operates the proportional valve and directional valve, and supplies the appropriate oil pressure to the ACD transfer or AYC torque transfer differential according to the signals from the 4WD-ECU.

SPECIFICATIONS

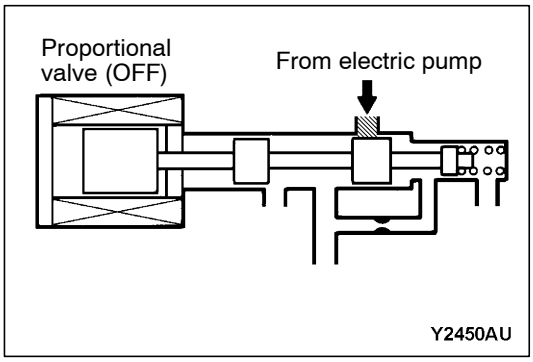
Specifications	Specifications
Electric pump	Trochoidal type
Operating oil	ATF SP III
Proportional valve	Current proportional control type
Directional valve	3 position electromagnetic switching method



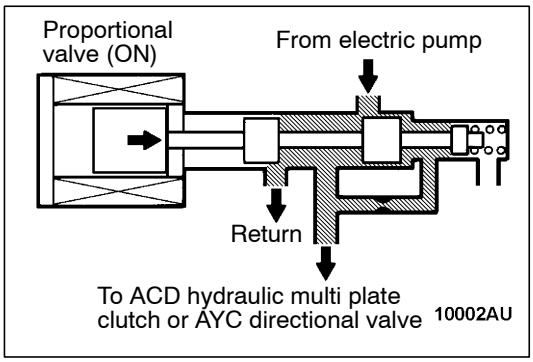


Proportional valve

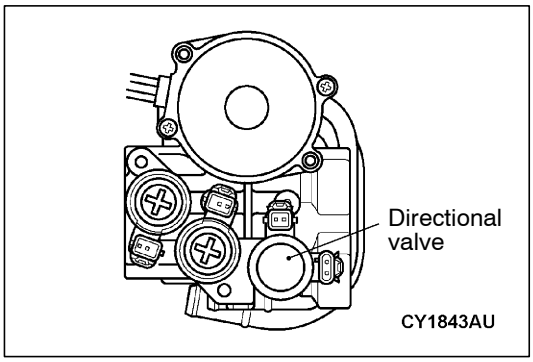
Supplies the oil pressure required for ACD or AYC control according to the instructions of the 4WD-ECU.



When the proportional valve is OFF, the oil pressure from the electric pump will be cut off by the proportional valve. For this reason, oil pressure will be supplied to the ACD or AYC and each system will be set into the non-operating state.

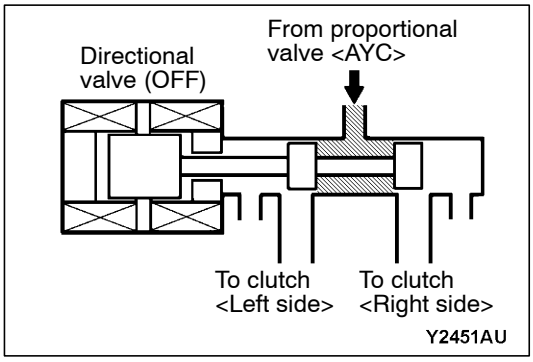


When the proportional valve turns ON, the proportional valve opens, and the oil pressure from the electric pump will be supplied to the ACD hydraulic multi plate clutch or AYC directional valve.

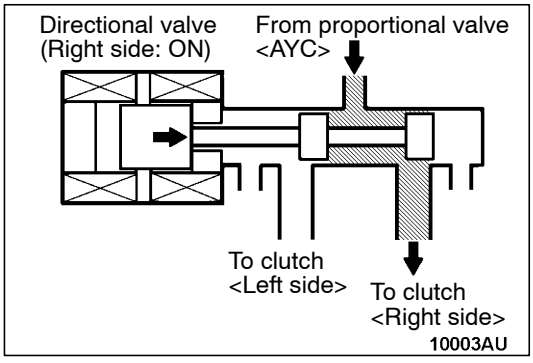


Directional valve

Supplies the oil pressure required for controlling the AYC clutch according to the instructions of the 4WD-ECU.



When the directional valve is OFF, the oil pressure from the proportional valve <AYC> will be cut off by the directional valve. For this reason, the clutch will set into the non-operating state without oil pressure supplied to each clutch of the AYC.



When oil pressure supply signal for the AYC clutch <Right side> is sent to the directional valve from the 4WD-ECU, the directional valve will move to the right. As a result, the oil pressure from the proportional valve <AYC> will be supplied to the AYC clutch <Right side>.
If the oil pressure supply signal to the AYC clutch <Left side> is sent to the directional valve, the directional valve will move to the left.

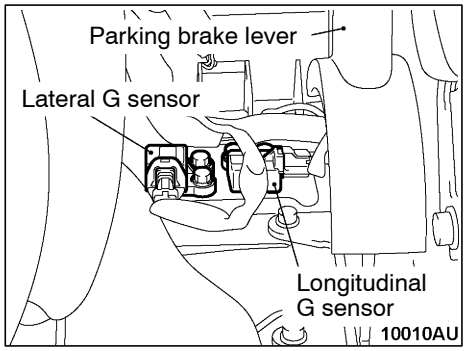
ELECTRONIC CONTROL SYSTEM

THROTTLE POSITION SENSOR

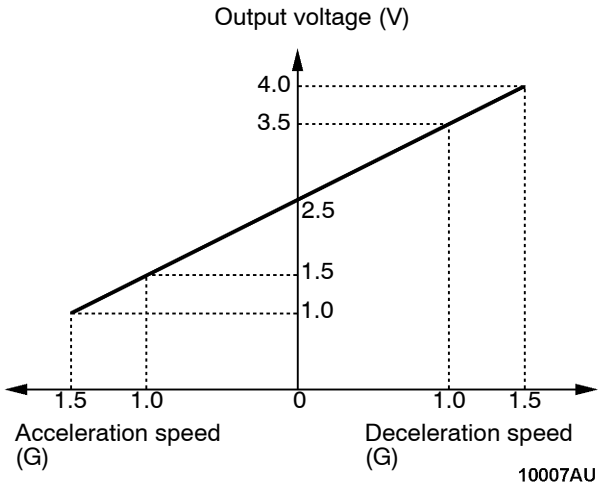
For detecting the throttle valve opening angle. Also used as throttle position sensor for engine control.

LONGITUDINAL G SENSOR/LATERAL G SENSOR

The longitudinal G sensor are sensors detecting the acceleration in the longitudinal directions of the vehicle, and are basically the same as those used conventionally.
The lateral G sensor is used for detecting the acceleration along the sides of the vehicle by changing the installing direction by 90°. The same sensor as the longitudinal G sensor is used.

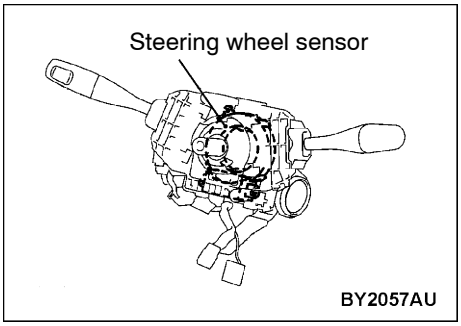


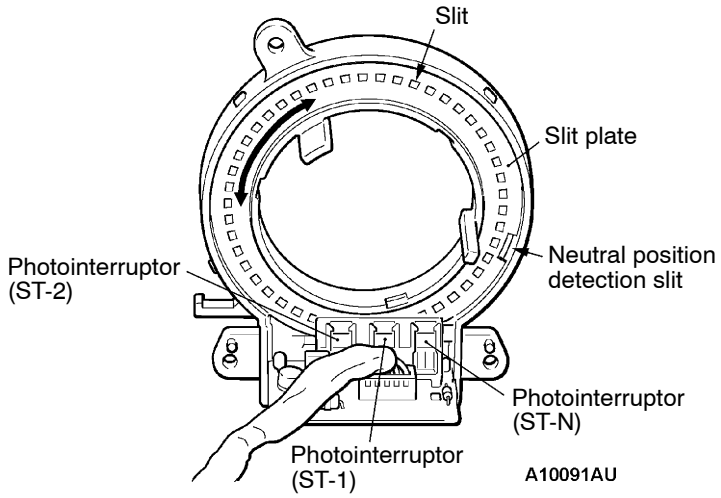
G-sensor output characteristics



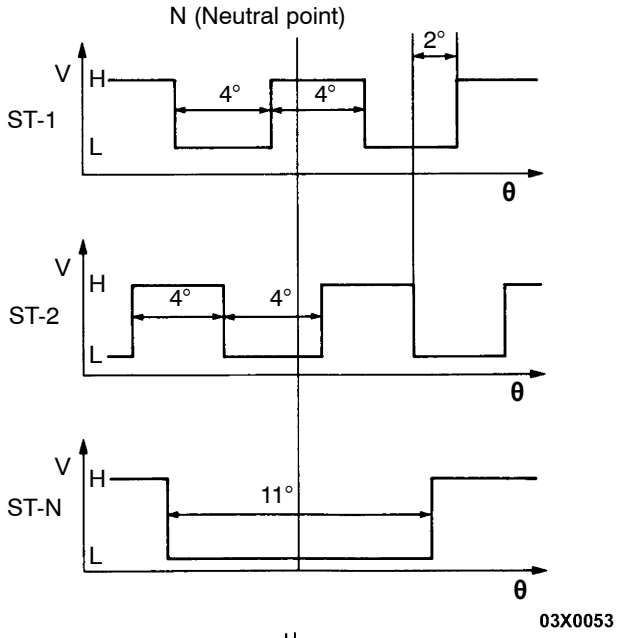
STEERING WHEEL SENSOR

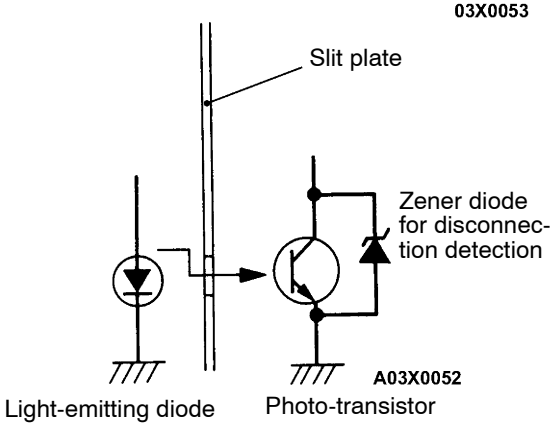
The steering wheel sensor is installed at the steering column, and is used to output steer angles to the 4WD-ECU as signals.
It is composed of the slit plate which rotates according to the movements of the handle and a three-set photointerruptor. The slit plate and photointerruptor have a sealed integrated structure to prevent the invasion of foreign particles as well as misoperations by external light. To detect malfunctions of the sensor output circuit, it is equipped with a zener diode for detecting disconnections parallel to the phototransistor.
The ECU calculates the steering angle by reading the signals of the steering wheel sensor after every certain period of time and calculating the total of the ST-1 signal and ST-2 signal.
The steering angle is obtained by taking the neutral position (ST-N output is L center) as 0°, and if there are changes, the steering angle is added with 2° for right and -2° for left. The output of the photointerruptor becomes L (low) when light passes through and H (high) when obstructed.

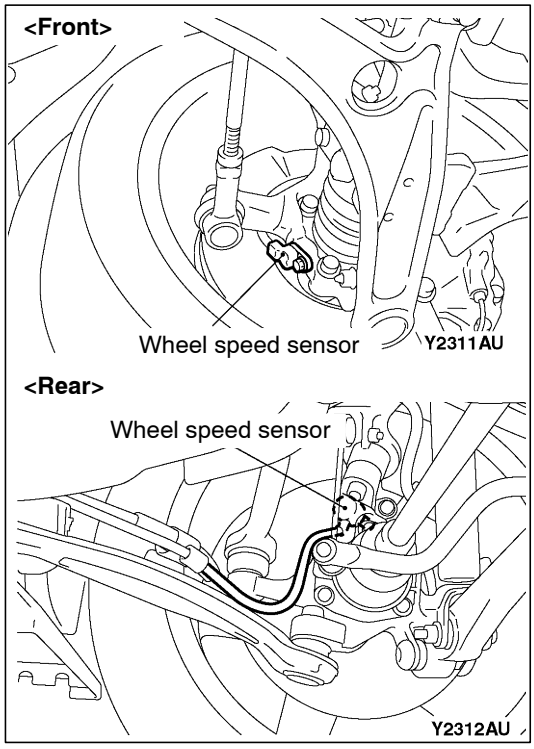




Output waveform of each sensor

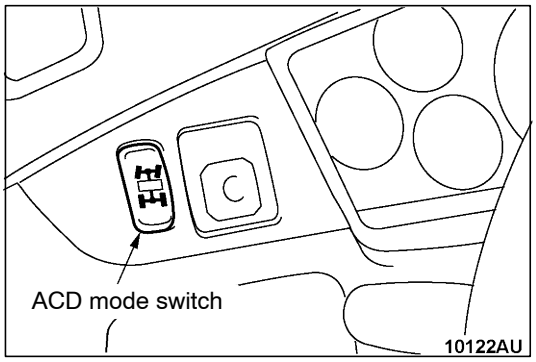






WHEEL SPEED SENSOR

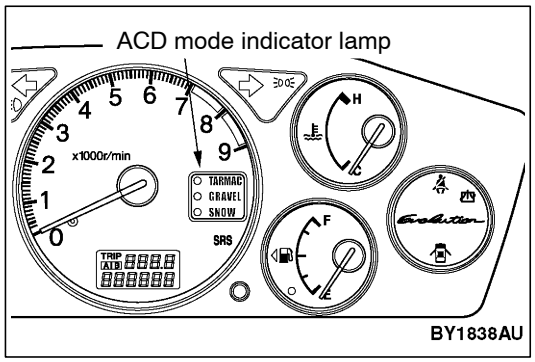
Sensor for detecting each wheel speed. It is the same as that conventionally adopted for the ABS. For vehicle with ACD and AYC, the wheel speed sensor signal waveform-shaped by the ABS-ECU is input to the 4WD-ECU.



ACD MODE SWITCH

When the ACD mode switch is pressed, the mode switches to TARMAC, GRAVEL, or SNOW.

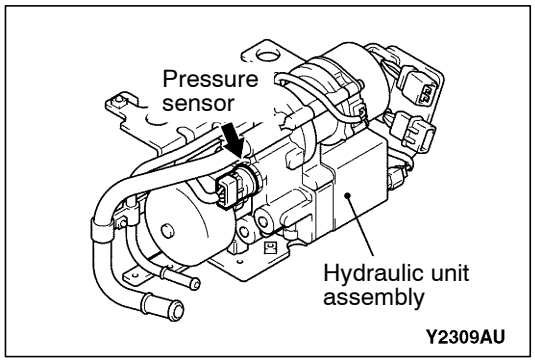
ACD mode	TARMAC	GRAVEL	SNOW
Good condition roads	Dry paved roads	Wet roads, gravel roads	Snowy roads



ACD MODE INDICATOR LAMP

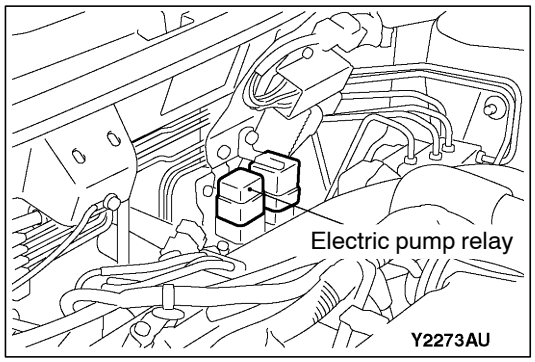
For about 1.5 seconds after the Ignition switch is turned ON, all ACD mode indicator lamps will light up. When the ACD mode switch is pressed, each mode (TARMAC, GRAVEL, SNOW) will light up alternately.
When the ACD or AYC malfunctions, all mode indicators will light up (until the ignition switch goes OFF*).

NOTE
*: When the vehicle is determined as having returned to normal according to the malfunction, the lamps will also be returned to their normal states.



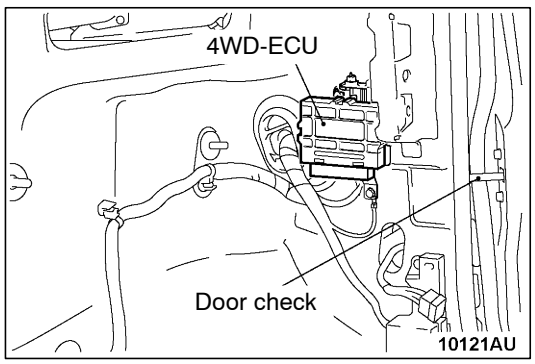
PRESSURE SENSOR

Detects the pressure of the accumulator, and sends the signal to the 4WD-ECU. The 4WD-ECU controls the operations of the electric pump on the basis of this signal.



ELECTRIC PUMP RELAY

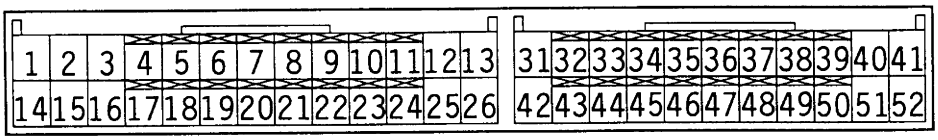
Supplies power to the electric pump according to the signal from the 4WD-ECU.



4WD-ECU

Determines the driving state, vehicle state, and road state according to the inputs of each sensor, idling information from the engine-ECU, and ABS monitor signal from the ABS-ECU to control the hydraulic unit.
The 4WD-ECU also has a diagnosis function which lights up all the ACD mode indicator lamps during malfunctions.

The terminals of the 4WD-ECU are arranged as follows.



Y2121AU

1. Proportional valve <ACD>
2. -
3. Proportional valve <AYC>*1
4. -
5. -
6. Wheel speed sensor <FL>
7. Wheel speed sensor <RR>
8. Wheel speed sensor <RL>
9. Wheel speed sensor <FR>
10. Pressure sensor earth
11. Lateral G sensor
12. -
13. 4WD-ECU power supply
14. Directional valve <Right>*1
15. Directional valve <Left>*1
16. Electric pump relay power supply
17. -
18. -
19. Wheel speed sensor earth <FL>*2
20. Wheel speed sensor earth <RR>*2
21. Wheel speed sensor earth <RL>*2
22. Wheel speed sensor earth <FR>*2
23. Longitudinal G sensor
24. Longitudinal G sensor and lateral G sensor earth *2
25. -
26. ECU earth
31. ECU backup power supply
32. Pressure sensor
33. Steering wheel sensor <ST-1>
34. Steering wheel sensor <ST-2>
35. Diagnosis data input/output
36. Idle switch
37. Parking brake switch
38. Stop lamp switch
39. TPS
40. ACD mode indicator lamp <TARMAC>
41. -
42. ECU earth
43. Pressure sensor power supply
44. Steering wheel sensor <ST-N>
45. -
46. Diagnostic control
47. ACD mode switch
48. -
49. ABS monitor *1
50. Earth*2
51. ACD mode indicator lamp <SNOW>
52. ACD mode indicator lamp <GRAVEL>

NOTE
1. *1 indicates that the terminal is omitted if only ACD is equipped.
2. *2 indicates that the terminal is added if only ACD is equipped.

DIAGNOSIS ITEMS

Code No.	Diagnosis Item	Mode indicator lamp (○: all lit, – : normally displayed)	Main diagnosis details
12	Power supply voltage (Valve power supply)	○	Open-circuit, short-circuit of power supply voltage system, or drop in voltage
13	Fail save relay	○	Open-circuit or short-circuit of ECU equipped fail save relay
21	Wheel speed sensor <FR>	○	Open-circuit or short-circuit of wheel speed sensor <FR> system
22	Wheel speed sensor <FL>	○	Open-circuit or short-circuit of wheel speed sensor <FL> system
23	Wheel speed sensor <RR>	○	Open-circuit or short-circuit of wheel speed sensor <RR> system
24	Wheel speed sensor <RL>	○	Open-circuit or short-circuit of wheel speed sensor <RL> system
25	Wheel speed sensor	-	Equipped with step-bore tire
26		○	Wheel speed sensor defect
31	Steering wheel sensor	○	Steering wheel sensor <ST-N,ST-1,ST-2> system opened or short-circuit

Code No.	Diagnosis Item	Mode indicator lamp (○: all lit, – : normally displayed)	Main diagnosis details
32	Steering wheel sensor <ST-N>	○	Steering wheel sensor <ST-N> system short-circuit
33		○	Fixing of steering wheel sensor <ST-N> system
34	Steering wheel sensor <ST-1, ST-2>	○	Short-circuit or fixing of output of steering wheel sensor <ST-1, ST-2> system
41	TPS	○	Open-circuit or grounding of TPS system
42		○	Short-circuit of TPS system
45	Pressure sensor	○	Open-circuit or short-circuit of pressure sensor system
46		○	Earth open-circuit of pressure sensor system
47		○	Power supply defect of pressure sensor system
51	Longitudinal G sensor	○	Open-circuit and short-circuit of longitudinal G sensor system
52		○	Longitudinal G sensor defect
56	Lateral G sensor	○	Open-circuit or short-circuit of lateral G sensor
57		○	Lateral G sensor defect
61	Stop lamp switch	○	Open circuit of stop lamp switch system
62	ACD mode switch	○	ACD mode switch is stuck
63	Parking brake switch	○	Short-circuit of parking brake switch or it has not been returned to designated position
65	ABS	○	Open-circuit of ABS monitor system or malfunction of ABS
71	Proportional valve <AYC>	○	Open-circuit or short-circuit of proportional valve <AYC> system
72	Directional valve <Right>	○	Open-circuit or short-circuit of directional valve <right> system
73	Directional valve <Left>	○	Open-circuit or short-circuit of directional valve <left> system
74	Proportional valve <ACD>	○	Open-circuit or short-circuit of proportional valve <ACD> system
81	Electric pump relay	○	Open-circuit or short-circuit of electric pump relay system
82		○	Electric pump malfunction or pressure sensor defect
84	AYC control	○	AYC control defect
85	ACD control	○	ACD control defect

SERVICE DATA

Item No.	Item	Unit
01	Wheel speed sensor <FR>	km/h (Displayed for every 1 km/h)
02	Wheel speed sensor <FL>	km/h (Displayed for every 1 km/h)
03	Wheel speed sensor <RR>	km/h (Displayed for every 1 km/h)
04	Wheel speed sensor <RL>	km/h (Displayed for every 1 km/h)
05	Wheel speed sensor <FR> (0.2 km/h)	km/h (Displayed for every 0.2 km/h)
06	Wheel speed sensor <FL> (0.2 km/h)	km/h (Displayed for every 0.2 km/h)
07	Wheel speed sensor <RR> (0.2 km/h)	km/h (Displayed for every 0.2 km/h)
08	Wheel speed sensor <RL> (0.2 km/h)	km/h (Displayed for every 0.2 km/h)
09	Vehicle speed	km/h
10	Battery voltage	V
11	Proportional valve current<ACD>	mA
12	Proportional valve current <AYC>	mA
13	TPS voltage	mV
14	Longitudinal G sensor voltage	V
15	Lateral G sensor voltage	V
16	Steering angle	deg
17	Steering angle speed	deg/s
18	Pressure sensor	MPa
19	Pressure sensor power supply	V
20	Valve power supply	V
21	Steering wheel sensor voltage <ST-1>	V
22	Steering wheel sensor voltage <ST-2>	V
23	Steering wheel sensor voltage <ST-N>	V
51	Idle switch	ON/OFF
52	Steering wheel sensor <ST-N>	ON/OFF
53	Steering wheel sensor <ST-1>	ON/OFF
54	Steering wheel sensor <ST-2>	ON/OFF
55	Steering wheel sensor learning <ST-N>	ON/OFF
56	Stop lamp switch	ON/OFF
57	Motor monitor	ON/OFF
58	Oil pressure state	HIGH/LOW
59	Directional valve <Right>	ON/OFF
60	Directional valve <Left>	ON/OFF
61	ABS monitor	ON/OFF
62	Parking brake switch	ON/OFF
63	ACD mode switch	ON/OFF

ACTUATOR TEST

Item No.	Content	Drive Specifications	Driving time	Check
01	Bleeding <ACD>	Outputs current to the proportional valve according to the steering angle.	5 minutes	Check that no air is discharged from the bleeder screw installed on the ACD transfer.
02	Bleeding <AYC>	Outputs current to the proportional valve according to the steering angle to operate the direction valve.	5 minutes	Check that no air is discharged from the bleeder screw installed on the AYC torque transfer differential.
03	Oil amount check	Operates the directional valve to the left and right.	20 seconds	Check the oil amount of the reservoir tank.
04	Electric pump drive	Operates the electric pump for 5 seconds.	To end of operations	Check the operating state from the operation sound of the electric pump.
05	ACD clutch operation check	Operates the proportional valve <ACD> to supply maximum oil pressure to the multi plate clutch.	1 minute	With the vehicle lifted up, check the operating state according to the speed difference between the front and rear wheels.
06	AYC clutch operation check <Left side>	Operates the directional valve, and supplies maximum oil pressure to the left side clutch.	1 minute	With the vehicle lifted up, check the operating state according to the speed difference between the front and rear wheels.
07	AYC clutch operation check <Right side>	Operates the directional valve, and supplies maximum oil pressure to the right side clutch.	1 minute	With the vehicle lifted up, check the operating state from the speed difference between the left and right rear wheels.
08	Control OFF	Turns OFF the electric pump relay, and ACD control and AYC control.	-	Check the difference between control ON and OFF in actual driving.

PROPELLER SHAFT

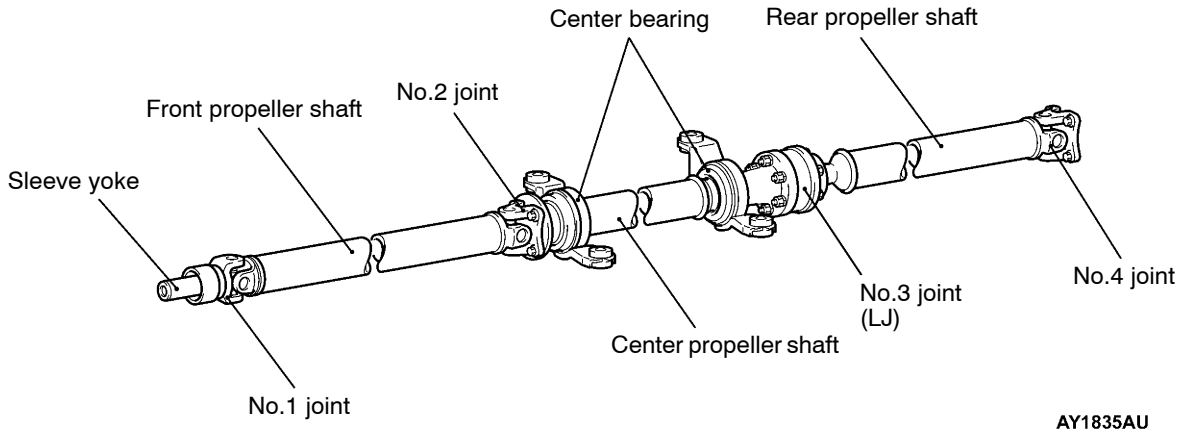
3 way split 4-joint type propeller shaft with center bearing is adopted.

SPECIFICATIONS

Item			Vehicles without AYC	Vehicles with AYC
Propeller shaft	Type		3 way split 4-joint type propeller shaft	
	Length × Outside diameter mm	Front	608.5 × 65	
		Center	551 × 65	
		Rear	750.5 × 65	768.5 × 65
Universal joint	Type	No.1	Cross type (caulking method)	
		No.2	Cross type (caulking method)	
		No.3	Constant velocity type (LJ)	
		No.4	Cross type (caulking method)	
	Bearing		Lubricationless type needle roller bearing	
	Journal diameter mm		16.3	

NOTE
The propeller shaft length indicates the length between the centre points of each joint.

CONSTRUCTION DIAGRAM



FRONT AXLE

The front axle consists of front hubs, knuckles, wheel bearings and drive shafts, and it has the following features.

- The wheel bearing is unit bearing (Double-row angular contact ball bearing) which is integrated with hub.
- The drive shaft incorporates B.J.-T.J. type constant velocity joints with high transmission efficiency and low vibration and noise.
- ABS rotors for detecting the wheel speeds are press-fitted to the B.J. outer wheels in vehicles with ACD or ABS.

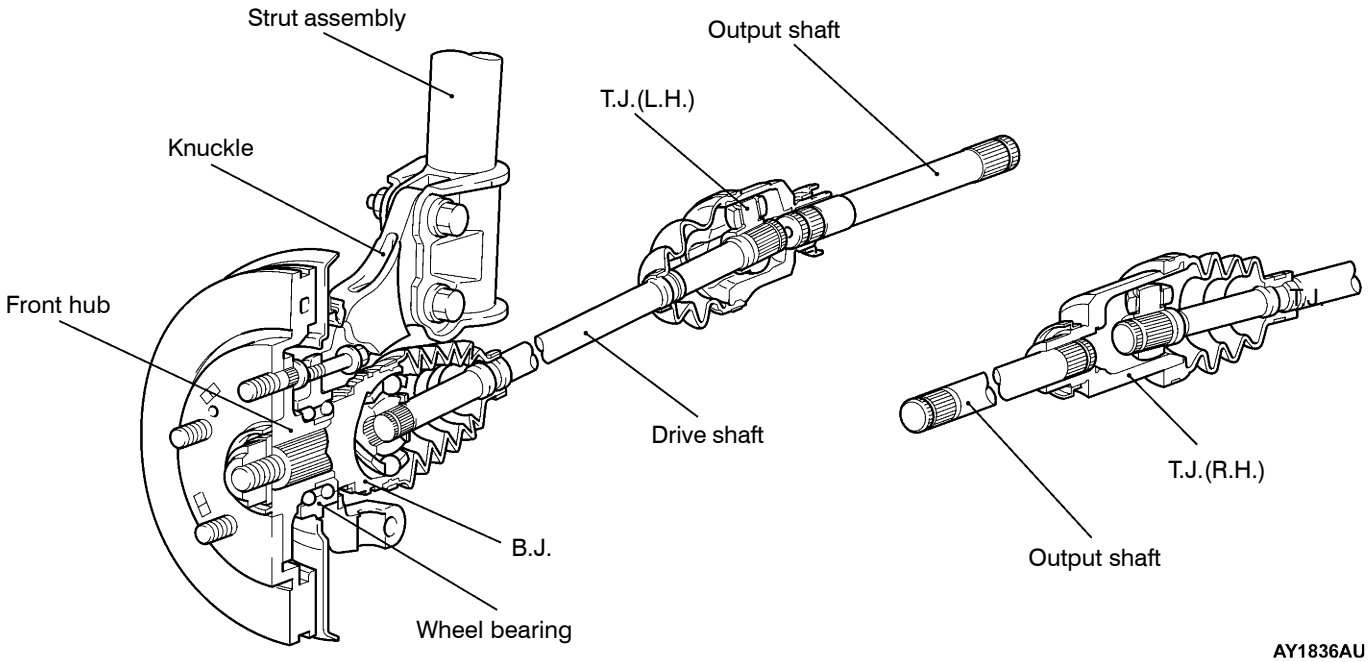
NOTE
1. B.J.: Birfield Joint
2. T.J.: Tripod Joint

SPECIFICATIONS

Item			Specifications
Wheel bearings	Wheel bearing type		Hub unit bearing (Double-row angular contact ball bearing)
	Bearing (outside diameter) mm		87*1
Drive shaft	Joint type	Outside	B.J.
		Inside	T.J.
	Shaft length*2 × Shaft diameter mm	Left	350 × 26
		Right	427 × 26

NOTE
*1: The wheel bearing is integrated with hub,only the outer diameter is shown.
*2: The shaft length indicates the length between the center points of each joint.

STRUCTURAL DIAGRAM



REAR AXLE

The rear axle consists of rear hubs, wheel bearings, drive shafts, and rear differentialand, it has the following features.

- The wheel bearing is a unit bearing (double-row angular contact ball bearing).
- The drive shaft incorporates B.J.-T.J. type constant velocity joints with high transmission efficiency and low vibration and noise.
- ABS rotors for detecting the wheel speeds are press-fitted to the B.J. outer wheels in vehicles with ACD or ABS.

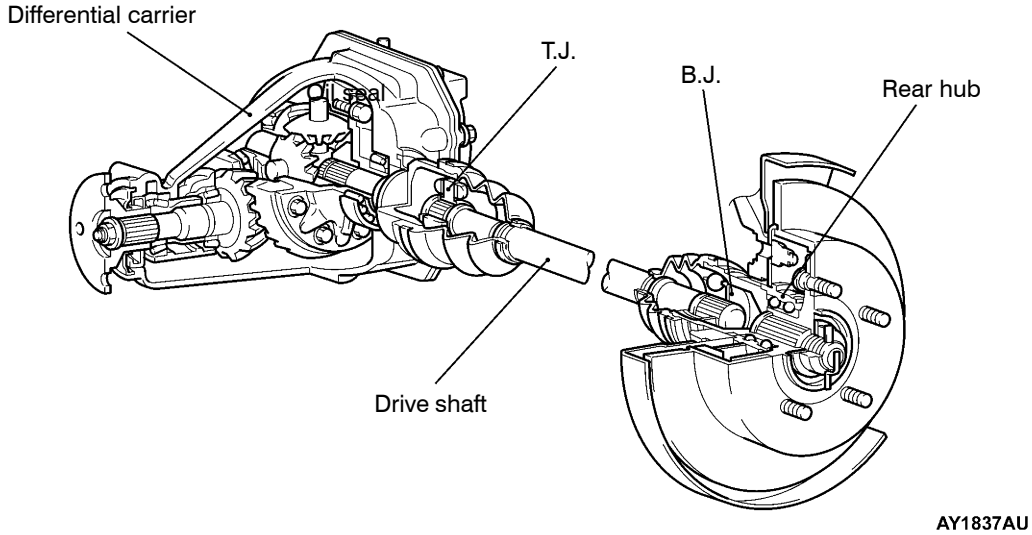
NOTE
1. B.J.: Birfield Joint
2. T.J.: Tripod Joint

SPECIFICATIONS

Item			Vehicles without AYC	Vehicles with AYC
Wheel bearings	Wheel bearing type		Unit bearing (Double-row angular contact ball bearing)	
	Bearing (outside diameter × inside diameter) mm		78 × 40	
Drive shaft	Joint type	Outside	B.J.	
		Inside	T.J.	
	Shaft length*1 × Shaft diameter mm	Left	483 × 25	426 × 25
		Right	573 × 25	446 × 25

NOTE
*1: The shaft length indicates the length between the center points of each joint.

STRUCTURAL DIAGRAM



DIFFERENTIAL

Mechanical type Limited Slip Differential <Vehicles without AYC> or Torque transfer differential <Vehicles with AYC> is adopted. About the structure of AYC, refer to P.2-3, manual transmission.

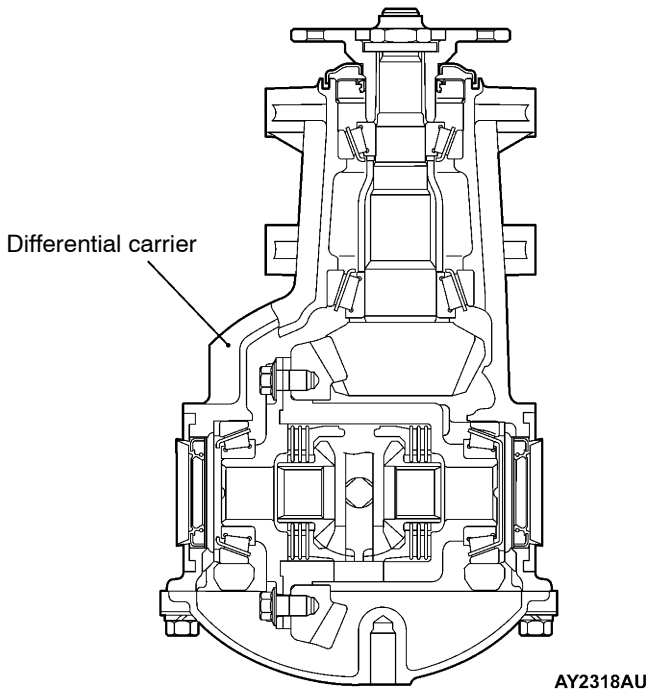
MECHANICAL LIMITED SLIP DIFFERENTIAL

SPECIFICATIONS

Item		Mechanical LSD
Reduction gear type		Hypoid gear
Reduction ratio		3.312
Differential gear type (Type × number of gears)	Side gear	Straight bevel gear × 2
	Pinion gear	Straight bevel gear × 4
Number of teeth	Drive gear	43
	Drive pinion	13
	Side gear	14
	Pinion gear	10
Bearings (Outside diameter × Inside diameter) mm	Side	72.0 × 35.0
	Front	62.0 × 25.0
	Rear	72.0 × 35.0

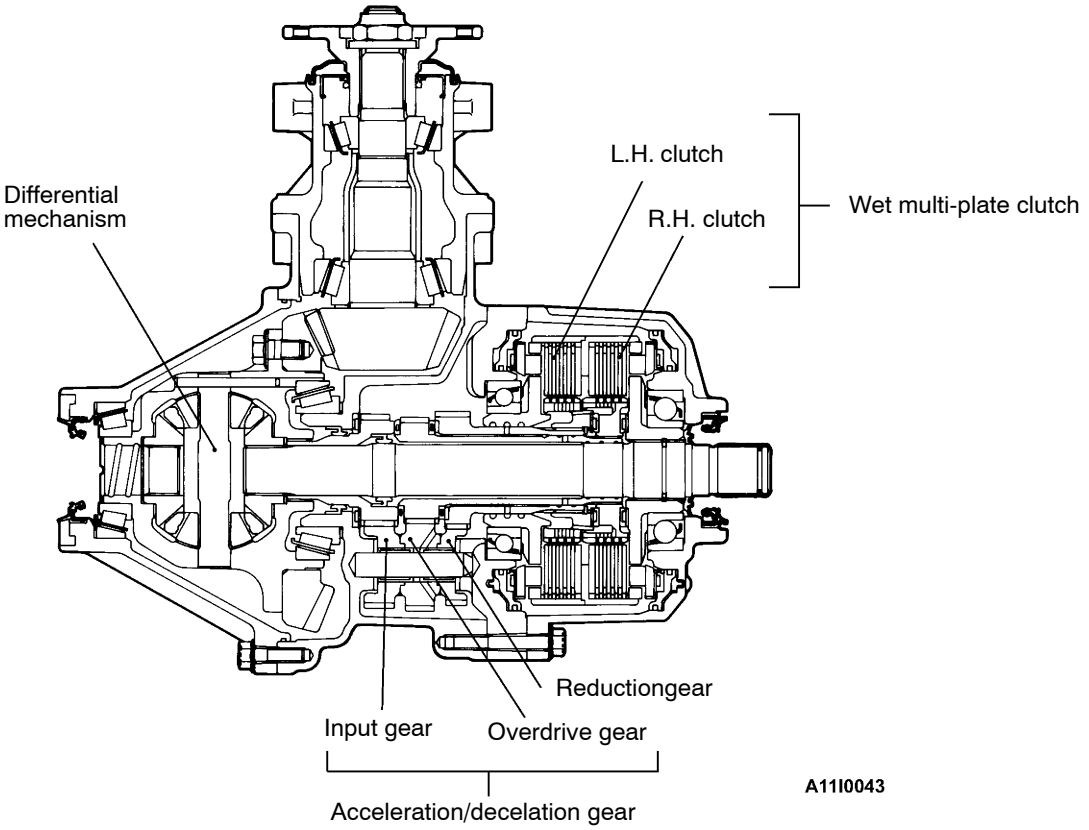
CONSTRUCTION DIAGRAM

<Mechanical LSD>



TORQUE TRANSFER DIFFERENTIAL

The torque transfer differential consists of differential mechanism,acceleration/decelation gear and two pairs of wet multi-plate clutch. The hipoid gear oil is used to lublicate differential part, ATF-SP III is used to lublicate torque movement part (acceleration/decelation gear and clutch).



DIFFERENTIAL MECHANISM

When the vehicle turns, admits the revolution difference between inner race and outer race.

ACCELERATION/DECELATION GEAR

Have the revolution speed of right and left wet multi-plate clutch to accelerate or decelate as oposed to the revolution speed of right wheel.

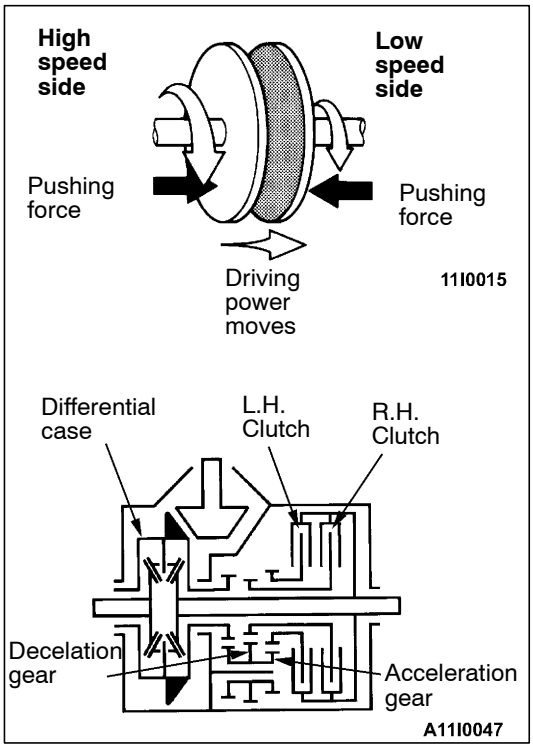
WET MULTI-PLATE CLUTCH

Have the torque to move from high speed wheel to low speed wheel.

L.H. clutch operate: decelation geer have the torque to move R.H. wheel to L.H. wheel.

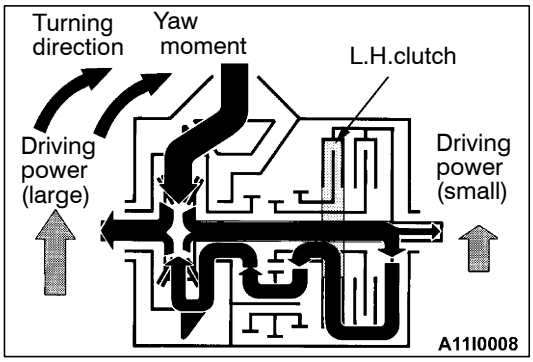
R.H. clutch operate: accelelation geer have the torque to move L.H. wheel to R.H. wheel.

The movement of torque is dependence on pushing force of the clutch.



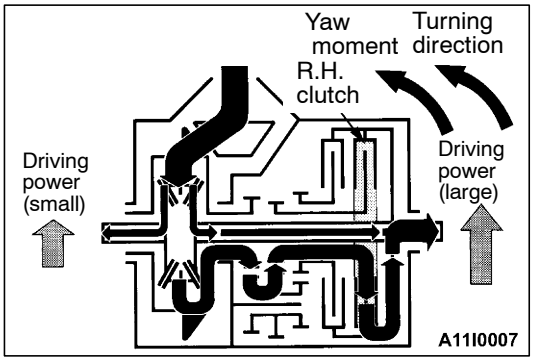
TORQUE TRANSFER DIFFERENTIAL MECHANISM

When high speed clutch is pushed, the driving power always moves from high speed side to low speed side, and controls the driving power with the aid of the property which the movement of driving power is proportional to the pushing force of clutch.
In torque transfer differential, acceleration/decelation gear always engages, and towerd to input speed from the differential case, L.H. clutch engaging decelation gear is revolutes in low speed, R.H. clutch engaging accelelation gear is revolutes in high speed.
In the other hand, the housing side of R.H/L.H. clutch is integlated to rear R.H. axle, if R.H. or L.H. clutch is opelated, the driving power can be moved to right or left.



THE FLOW OF DRIVING POWER

(1) L.H.CLUTCH OPERATE
In order to boost the driving power of L.H. wheel, when L.H.clutch is operated,a part of the driving power of R.H. wheel flows to the differential case, the driving power of L.H. wheel is boosted.
The result of this, the yaw moment occures in a right to the vehicle.



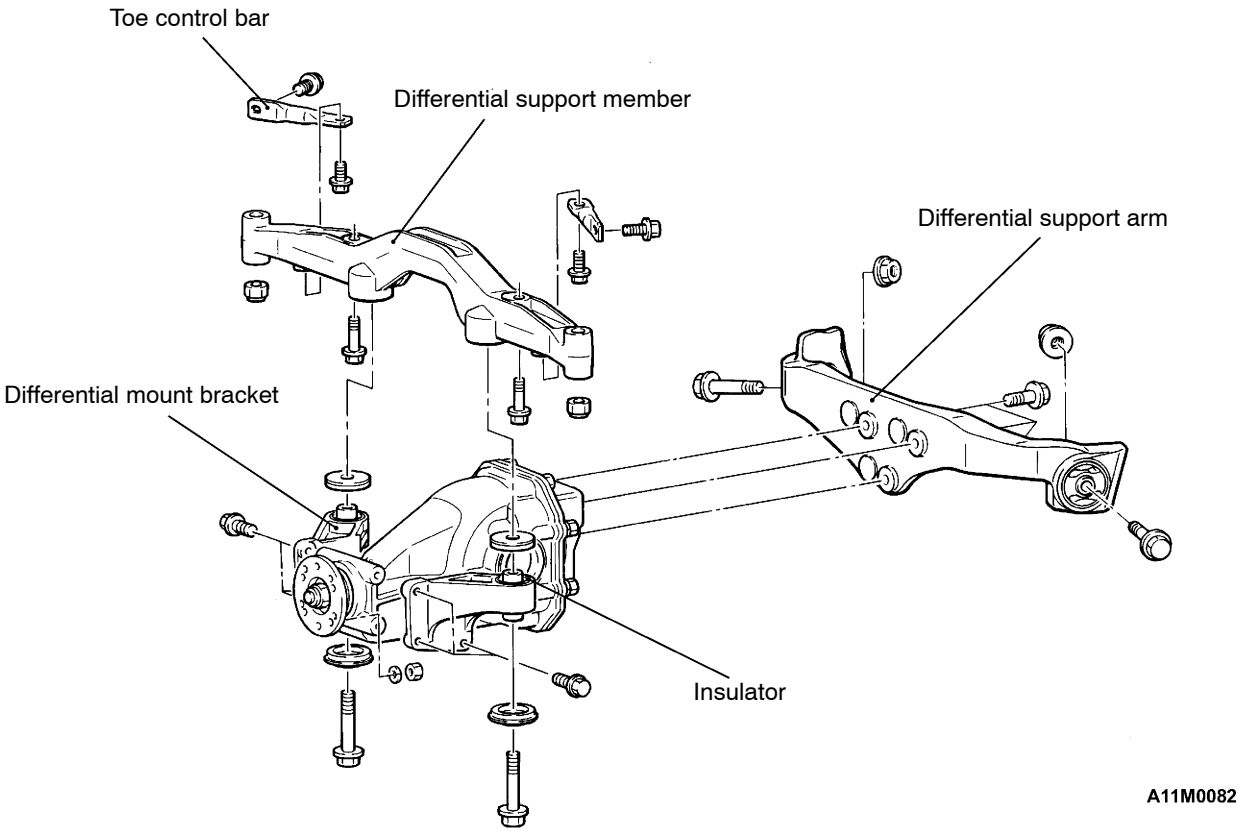
(2) R.H.CLUTCH OPERATE
In order to boost the driving power of R.H. wheel,when R.H.clutch is operated, a part of the driving power of L.H. wheel flows to the differential case, the driving power of R.H. wheel is boosted.
The result of this, the yaw moment occures in a left to the vehicle.

DIFFERENTIAL MOUNT

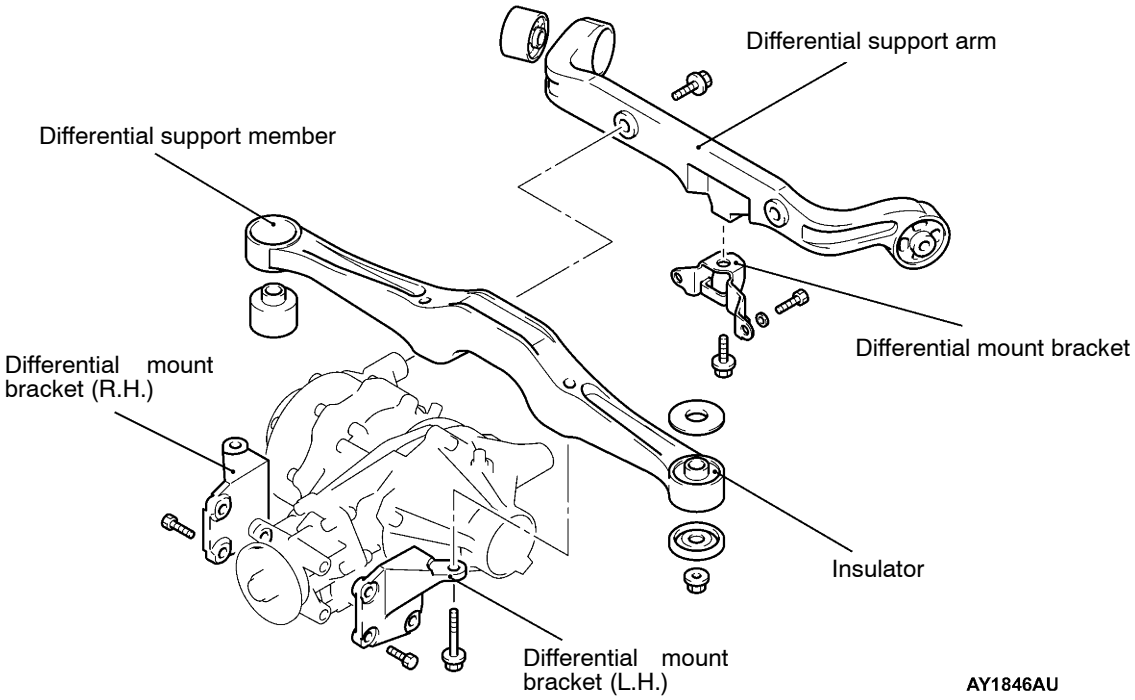
The front of differential carrier is suported with the differential support member via the differential mount bracket with insulator,and the rear is suported with the differential support arm. <Mechanical LSD>

The front of torque transfer differential is supported with the differential support member with insulator via the differential mount bracket,and the rear is supported with the differential mount bracket and the differential support arm. <AYC>

<Mechanical LSD>



<AYC>



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